The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. VII. No. 168 SEPTEMBER 2, 1922 Prepaid Annual Subscription United Kingdom, £1.1.0; Abroad, £1.6.0.

Contents

PAGE

EDITORIAL NOTES: Chemical Trade in Europe; On the Theory of Solution; Chlorination of Water; A ew British Dyestuff; The Plauson Colloid Mill; The CHEMICAL AGE Year Book 303

Chemistry in the Service of the Community.—I. By Arnold R. Tankard, F.I.C. 306

The Problem of Solution: An Extract from "The Compleat Chymist." Being a Conference betwixt a Chymist, a Farmer, a Brewer, and His Friend 308

Progress of the British Fine Chemical Industry; Protecting the French Dye Industry 311

Reviews 312

CORRESPONDENCE: The Manufacture of Fertilisers (A. E. Marshall); Corrosion of Metals by Acid Mine Waters 313

Colloid Chemistry and Industrial Applications 314

Basic Slag Manufacture; Proposed Presentation to Birmingham Chemist; German Aluminium Industry; Work of Public Analysts in 1921 315

Safeguarding of Industries Act: Report of Glass Bottles Committee; Brass Casting Research; Institute of Metals; Greek Olive Oil Production 316

Duty on Oxalic Acid; Fatality at a Manchester Chemical Works; Canadian Substitute for Pine Oil; New Soapstone Deposits in Canada 317

From Week to Week 318

References to Current Literature 319

Patent Literature 320

Market Report and Current Prices 323

Scottish Chemical Market 325

German Chemical Trade Notes; The Chilean Nitrate Situation 326

Company News; Chemical Trade Inquiries; Tariff Changes .. 327

Commercial Intelligence; New Companies Registered 328

NOTICES:—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

The prepaid subscription to THE CHEMICAL AGE *is 21s. per annum for the United Kingdom, and 26s. abroad. Cheques, Money Orders and Postal Orders should be made payable to Benn Brothers, Ltd.*

Editorial and General Offices—8, *Bouverie St., London, E.C.4.*

Telegrams: "Allangas, Fleet, London." Telephone: City 9852 (6 lines).

Chemical Trade in Europe

THE present economic position of Central Europe, and especially the recent alarming movements in German exchange, are matters of the most serious import to all concerned in industry, and to none more than to firms engaged in the chemical trade. In THE CHEMICAL AGE about two years ago appeared an impression of the German position by one of the first chemical merchants to enter the country after the war. His view was that the economic collapse of Germany would be a disaster, since it must inevitably involve other European countries, and that what was most to be desired was a moderate recovery. The soundness of that estimate has since been fully confirmed, and what our correspondent indicated then as the right policy every real statesman in Europe now desires to bring about. One thing is certain from the business point of view. Trade cannot be carried on without some reasonable measure of stability. Fluctuations of a thousand or more per day in the value of the mark make contracts impossible. If the depreciation was "engineered" in the early stages the movement has obviously now got beyond the control of its authors. Until some standard is restored, trade must be held up. How that is to be done is one of our unsolved problems. But one step towards it would be a final settlement of the reparations problem. We may be too lax; our French friends may be too rigid. Somewhere between them perhaps, is the right line. The essential thing is that some definite line should be fixed. That done, the other problems may be tackled in turn.

On the subject of trade with Germany, there is still much loose thinking. Some of the appeals to so-called "patriotism" merely serve to remind one of Johnson's cynical definition. This is a problem for the trader himself to settle, and the position, when examined, seems simple enough. A peace, to be effective, must be a real peace. When Germany sued for peace the terms of surrender were dictated by the Allied military leaders. In the minds of many there was a feeling that if, after her military collapse, Germany had undergone another two months of persistent and energetic "clouting" she would have got no more than she deserved. The price of that, however, would have been a heavy loss of life on our own side, and the price was decided to be too high. Peace accordingly followed, and the more complete and speedy it is the better for everybody. To be a real peace, it must leave behind much that it is difficult to forget, and must mark a new and a clean beginning.

We believe this sort of peace is what traders themselves most desire, and their part in bringing it about through a restoration of trade is a great one, if only they are given a fair opportunity. Looking back on the very difficult period Europe has passed through, the members of the British chemical trade—manufacturers and merchants—have an excellent record. Losses in many cases have been heavy, but they have been borne with dignity and patience. Large staffs and organisations were for a time almost idle, but they have been honourably maintained and kept together. The way in which the chemical industry has come through is a credit to all engaged in it, and a convincing testimony to its real stability. Fortunately conditions of late have been easier. If Central Europe once settled down we believe a rapid recovery would follow, in which this country would have a great share. For all these reasons our good wishes must go out to those who are now striving to find a stable basis on which to reconstruct European exchange and trade.

On the Theory of Solution

THE article by "Dr. Lagueur" on the Theory of Solution published in this number is an attempt to raise, in an unconventional way, a few of the controversial points in this great problem. One of the commonest operations in the works or the laboratory is to dissolve a substance in water, and most people really know less about the chemistry of this operation than they care to admit. The literature on the subject is very considerable; the undisputed facts of fundamental importance are comparatively few. To discuss the whole problem adequately is a task too great for a weekly journal, but the time appears to be opportune for a reconsideration of the changes which are alleged to take place in the act of solution. It may be that those who are competent to form an opinion on this point will, after weighing the arguments on both sides, be satisfied that the doctrine of *ionic dissociation* is proved beyond question; on the other hand, they may come to the conclusion that *ionic dissociation* is a convenient hypothesis the truth of which is not a matter of great consequence; some few may, perhaps, be of opinion that other assumptions afford a more probable explanation of the phenomena of solution. In any case it is of some importance that we should endeavour to learn the truth about an operation which occurs in a large percentage of chemical processes. The form in which the case is stated is calculated to arrest attention and excite controversy, and it would be interesting as well as useful to have the opinions of authorities on the points raised by our correspondent.

A little scepticism about theories which are generally accepted and an honest effort to interpret facts which do not fit well into our ideas of science are both aids to progress. This is what we have in mind in publishing so long an extract from the much longer dialogue our correspondent submitted to us. We feel no hesitation in advising our readers not to be bound down by old traditions; our pages show that we have ourselves often departed, with excellent effect, from the rather funereal conventions of scientific and technical publications. In particular, the divine gift of humour is so sparingly possessed and still more so sparingly employed in the exposition of science that its use in catching the attention and surprising people out of accustomed mental ruts may be unreservedly commended. In reading "Dr. Lagueur's" manuscript, therefore, it was more of a satisfaction than a shock to discover that what began as a frivolous conversation in a tavern should turn into a serious argument on a matter of scientific theory. This, after all, is a well-approved didactic method of the evangelical school, and science ought not to be above learning from religion. The manuscript, indeed, reminded us rather of those well-intentioned tracts of our early days which began with a shipwreck, a mad dog, or a house on fire, and after a page or two of real excitement turned into an argument or an exhortation on the efficacy of prayer, with copious extracts from the Prophets or the Epistles. Science could do very well with a few really live tractarians; and certainly every publication committee should have at least one approved humorist on it—if he could stand it!

Chlorination of Water

IN THE CHEMICAL AGE of December 4, 1920, reference was made to the developments which have taken place in recent years in connection with methods for effecting the sterilisation of water. It has been pointed out by Captain Arthur Stanley that the most efficient methods of water filtration can only bring about a reduction of 98 per cent. of the total number of bacteria present, so that sterilisation should be considered an essential. This may be conducted either by chemical or physical methods; but the former are to be preferred as they are cheap, comparatively easy to manipulate, and capable of very exact operation. The substance most commonly employed for the purpose is chlorine, which may be used either in its elemental condition or in the combined form such as chloride of lime or bleaching powder. During the war several attempts were made for Army purposes to do away with bleaching powder and to substitute chlorine gas, the chief argument being that with chlorine itself the water has a far less marked taste than is the case when bleach is utilised. Eventually the chlorine gas process was brought to such a stage of perfection that it was adopted as a standard for practically all types of water purification plants in the Army.

We have referred back to the wartime uses of chlorine gas for the reason that Sir Alexander Houston, the Director of Water Examination to the Metropolitan Water Board, has just issued his report on the chemical and bacteriological examinations which he conducted in connection with London water during last year, and it is of particular interest to note that some remarkable results have been obtained with chloride of lime in contradistinction to chlorine gas. As will be well remembered, last year, so far as the supply of water was concerned, has never probably had a parallel, and questions arose as to the possibility of making use of supplies of water which were recognised as impure. Recourse, in fact, was had to expedients of the kind, and the success achieved was such that not only did the water leave nothing to be desired from the standpoint of purity, but a very considerable monetary saving was effected. By way of example, it may be pointed out that during 1921 nearly 25,000 million gallons of water were treated with chloride of lime, the cost of which was about £2,200, rather more than 12 lb. of bleaching powder being used for each million gallons of water dealt with. As might be expected, taste troubles were experienced in the early stages, but these were entirely overcome by the use of potassium permanganate and by the erection of a sulphurous acid dechlorination plant. Sir Alexander refers to the objections raised by those who have a strong disinclination to drinking what they call a "doped" water; but he remarks that, if rivers are to be used as sources of water supply, we must look rather to the innocuous character of the finished product than to its antecedents, particularly "as there is absolutely no convincing evidence that a properly chlorinated water is in any way injurious to health." To the chemical mind the report is mainly of interest because it seems to have disposed of the contention that chloride of lime, owing to difficulties with taste, is not altogether a suitable agent for the purpose.

A New British Dyestuff

AMONG the many dyestuffs, previously only produced in Germany, which are now being manufactured by the British Dyestuffs Corporation is one the history of which has a special interest for the British colour industry. This is a bright greenish yellow, chiefly employed in calico printing, which is known by the name of "Thioflavine T" or "Rhoduline Yellow." It was discovered in 1888 by Professor Arthur G. Green and the late Dr. T. A. Lawson, but the firm for whom these chemists were working did not take the matter up and the colour was never manufactured in this country. The discovery was, however, published by Green and Lawson in the *Journal* of the Chemical Society in the following year, and the preparation of the dyestuff was described. At about the same date it was put upon the market by Cassella and Co., of Frankfurt, and was manufactured by them and by other German firms from that time forward.

The manufacture is being commenced at Huddersfield under the direction of the original discoverer, and incidentally it may be mentioned that the chemist in charge of the operation was born in 1888, the year in which the dyestuff was discovered. The English product, it is stated, is fully equal to the German in quality. The history of this dyestuff adds another example in support of the contention that the decadence of the British dyestuff industry subsequent to 1870 was chiefly caused by the inability to appreciate the results of research, which, in turn, was due to the fact that the conduct of the industry had fallen into the hands of men who either were not chemists or had little or no instinct for appreciating the relation of chemistry to industry.

The Plauson Colloid Mill

THE recent articles by Dr. S. P. Schotz on possible industrial applications of the Plauson Colloid Mill have attracted considerable interest in this country, in the United States, and on the Continent. The class of inquiries which are reaching us is illustrated by the following extract from a letter from a large New York chemical company: "In THE CHEMICAL AGE for June 17, 1922 (pp. 790-791) is an article on 'Industrial Applications of the Colloid Mill,' by S. P. Schotz, D.Sc., F.I.C., in which are discussed the possibilities offered by the invention and development of the Plauson Colloid Mill. We are very much interested in this mill, and would very much appreciate it if you would pass this letter on to the manufacturers, as we should like to have some descriptive literature on its equipment, capacities, etc., and the cost f.o.b. shipping point. We have no information as to where this mill is manufactured, and consequently are taking this method of getting in touch with the makers." We have already passed on a number of similar inquiries, and as there may be numerous other firms similarly interested it may be well to publish the addresses. Particulars as to the mill may be obtained from Plauson's Mill and Filter Press Co., 17, Waterloo Place, London; or from the Plauson Institute, Jarrestrasse, Hamburg.

The "Chemical Age" Year Book

THE announcement of the decision of the proprietors of THE CHEMICAL AGE to publish a "C.A." Year Book, Directory, and Trade Guide, has been received very cordially, judging by the inquiries received respecting it. The exact date of publication has not been finally fixed, but the Year Book will be on sale in good time for use from the beginning of the new year. The editorial matter, which will include specially prepared technical and trade information not provided, we believe, by any other publication, is well in hand, and about half the space allocated to advertisements has already been booked by leading firms who have been quick to see the importance of securing good positions in a work that promises to be very widely employed for daily use and reference by business men. Inquiries on this matter should be addressed to the Manager at 8, Bouverie Street, E.C.4.

Points from Our News Pages

Mr. A. R. Tankard, F.I.C., contributes the first of a series of articles on "Chemistry in the service of the community" (p. 306).

An interesting article, which a correspondent has cast into the picturesque and suggestive form of a personal dialogue, is published on "The problem of solution" (p. 308).

At the annual meeting of W. J. Bush and Co., reference was made to some of the typical difficulties recently experienced in the chemical industry (p. 311).

Recent books on proteins, qualitative chemical analysis, and laboratory exercises in inorganic chemistry are reviewed (p. 312).

Mr. A. E. Marshall, chemical engineer, Baltimore, writes in relation to the recent article by Mr. Leonard Carpenter on "The manufacture of fertilisers" (p. 313).

Extracts are published from a summary report of a British Association committee on "Colloid chemistry and its industrial applications" (p. 314).

An increased inquiry is recorded in our London Market Report, with markets firm on the whole and export trade a shade better. (p. 323.)

According to our Scottish Market Report, prices for English manufactured chemicals are steady, and inquiries are fairly plentiful, but the number of orders booked is small (p. 325.)

Book Received

THE PETROLEUM AND ALLIED INDUSTRIES. By J. Kewley. London: Baillière, Tindall and Cox. Pp. 302. 12s. 6d.

The Calendar

Sept. 4	Institution of Rubber Industry: "Rubber Latex in Paper Making." Frederick Kaye. 7.30 p.m.	Engineers' Club, Coventry Street, London.
4-9	American Chemical Society: Annual Meeting.	Carnegie Institute of Technology, Pittsburg, U.S.A.
6-13	British Association for the Advancement of Science: Annual Meeting.	City Hall, Hull.
19-22	Institute of Metals: Autumn Meeting.	Swansea.
Oct. 9-15	International Congress on Liquid Fuels.	Paris.

Chemistry in the Service of the Community—I.

By Arnold Rowsby Tankard, F.I.C.
(*Public Analyst and Bacteriologist to the City of Hull*)

The following article, the first of a series of three, describes the various ways in which chemistry has come to the aid of the agriculturist in replacing the exhausted fertility of soils and in securing new sources of nitrogenous foods for plant life. In the remaining articles the relation of chemistry to numerous other industries will be discussed.

It is apparent to all who have followed the progress of Science during recent years that the close interdependence of the sciences makes it difficult in many cases to ascribe any given discovery or addition to our useful knowledge to a single science. Some of the subjects discussed in these articles may, therefore, represent the combined efforts of workers in several fields, but it is to be understood that chemistry is the science mainly concerned, and the one to which most credit is due.

Agriculture may fairly be claimed to be the oldest industry, and as such demands our first consideration. As one proceeds by train or otherwise in any direction in this country, one is impressed by the thought that even in industrial England agriculture is still the premier industry. Mile after mile of cultivated land, with comfortable farmsteads at frequent intervals, meets the eye on all sides; and it is plain that this important industry is worth looking after, as on it depends our home food supply, both animal and vegetable. Taking a world-wide view of the industry, besides our foodstuffs agriculture gives us clothing and textiles generally, for cotton and flax must be grown, and sheep for wool must be reared; it gives us leather, rubber, timber, paper, medicinal plants for drugs, such as aconite, belladonna, opium and nux vomica; oils and fats, largely obtained from plants and trees, and tobacco and fermented drinks, produced by specialised branches of agriculture. Surely there is no industry which touches ancient and modern civilisations at so many points! And late happenings have shown us how dangerous it is to ignore the legitimate claims of this all-important industry of agriculture so far as our food supplies are concerned.

Agriculture owes a great debt to those pioneer agricultural chemists, Lawes and Gilbert, two enthusiastic workers who founded the Rothamsted Experimental Farm Station over 80 years ago, and carried on valuable and successful experiments for many years. Largely as a consequence of the results of these early workers, and of Hall and Russell in our time, chemistry is yearly adding to our knowledge of scientific agriculture, and is putting the new knowledge at the disposal of the farmer, to the great benefit of the community.

Agricultural chemists have done much useful work in elucidating the principles of the rotation of crops, and in producing artificial fertilisers to enhance the quality and to increase the yield of crops. In former days farmyard manure had to be applied to the land to the extent of 14 tons per acre, and usually this amount of manure was not available in most areas. Lawes and Gilbert's mixed artificial fertiliser was much more concentrated, and was available in large quantities; and, as Russell has shown, an equivalent dressing of this fertiliser was 6 cwt. per acre. A reduction from 300 tons of farmyard manure to less than 7 tons of artificial fertiliser for an ordinary sized field represents a difference in cartage, the significance of which will be best appreciated by the farmer himself.* Nor is this the only, nor even the main, benefit to be derived from the use of chemical fertilisers. Different crops require different kinds and amounts of the fertilising ingredients in natural and artificial manures, and it is only by the use of special mixtures that these requirements of the crop can be satisfied.

* E. J. Russell, *Modern Applications of Chemistry to Crop Production*, Institute of Chemistry Lecture, 1921.

The chemist has shown that the growing crop takes from the soil and from the atmosphere what it needs for its growth and nutriment; and after a time all soils, unless specially treated, become exhausted of their fertilising components. These have been shown to be carbon dioxide, water, nitrogen, phosphorus, and potash. All growing crops require carbon dioxide and water, but individual crops vary considerably in their requirements of nitrogen, phosphorus, and potash. Wheat, for example, needs much nitrogen, and successive wheat crops on the same soil would rapidly exhaust it of this important ingredient. The rotation of crops is, therefore, practised in order that such exhaustion of the soil shall be obviated as far as possible; but ultimately it is necessary, to secure the best results, to resort to intensive measures, by using natural and artificial manures, to make good the deficiencies of the soil.

Synthetic Nitrogenous Fertilisers

Now the supplies of phosphorus and potash for fertilising the soil are usually adequate; mineral phosphates, bone phosphates, and the basic slag lining of steel furnaces being the main sources of the former, and the natural deposits of alkali-metal salts (*e.g.*, in Alsace) the chief source of the latter. But supplies of combined nitrogen have not always been sufficient for agricultural purposes. It is true that we have a certain supply in farmyard manure, in the beds of Chilian saltpetre, and in the sulphate of ammonia obtained as a by-product in the distillation of coal. But the increased output of nitrogenous compounds from all these sources has not kept pace with agricultural requirements throughout the world, and some day—not, perhaps, far distant—the natural beds of nitrate will be exhausted. This was the position when the chemist Crookes in 1898 uttered his serious warning to the world. He showed that wheat-eaters were within sight of a great scarcity of food, that the land was becoming exhausted of the much-required nitrogen, and that in a comparatively few years no available wheat-lands would be left. As the world yield of wheat per acre was at that time—24 years ago—only 12.7 bushels, Crookes emphasised the necessity of increased production per acre, and he stated that this could be accomplished only by liberal dressings of nitrogenous manures. Where were these to be obtained in sufficient amounts? Our natural resources were dwindling in comparison with our needs, but there lay to our hands an unlimited, untapped reservoir of nitrogen in the air, which contains nearly 80 per cent. of this element. Crookes showed, therefore, that the solution of this urgent problem lay with the chemist, and that he must produce the necessary combined nitrogen from the free nitrogen in the atmosphere. To-day this is an accomplished fact, and by several processes, now working successfully in various parts of the world, nitrogenous fertilisers are being prepared by chemical or electrical synthetic processes. The most important of these are:

(1) Production of cyanamide (nitrolim) by passing air, or nitrogen from the air, over calcium carbide prepared in high temperature furnaces. The cyanamide can be used directly on the land, or its contained nitrogen can be liberated as ammonia by passing steam over it;

(2) Production of synthetic ammonia, by the Haber and Claude processes, by passing nitrogen and hydrogen

over oxide of iron or other activator at a high temperature and under considerably increased pressure, whereby a yield of 42 per cent. (Claude) of the nitrogen as ammonia is said to be obtained;

(3) Production of nitric acid synthetically, in several ways, generally involving the passage of nitrogen and oxygen through a chamber containing a flaming electric arc, or by the explosion of these gases after admixture with a combustible gas; also by the oxidation of ammonia in presence of air and a heated platinum gauze.

Some of these processes are at work in this country, and great developments are expected almost immediately. The result will be, and to a large extent is already assured, that we shall have in the immediate future an abundance of nitrogenous fertilisers and ammonium salts and nitrate for many other purposes. Thus the chemist, aided by the engineer, has solved a mighty problem, fraught with tremendous issues for the human race. The future of our food supplies is now secured.

To-day, perhaps the most important technical problem before the agricultural chemist is to determine the best method of increasing the amount of organic matter in the soil, for on the presence of adequate amounts of humus or humus-forming material depends, amongst other things, the moisture-retaining properties of the soil, enabling crops to withstand prolonged drought without serious detriment. Much has already been accomplished to this end, and it may safely be said that the new knowledge of the chemistry of the soil is of the highest practical importance to every one of us.

The Chemistry of Foodstuffs

The vegetable and animal foodstuffs grown and raised by farmers throughout the world are complex mixtures of compounds with which the chemist has long been concerned in an attempt to resolve their composition and to determine their origin. A considerable sum of knowledge is gradually accumulating which will one day put us in possession of something like a clear picture of the methods adopted by plants in building up their fibrous framework and nutritive inner contents, and by the animal body in bringing the vegetable and animal substances used as food into a form in which they can be digested and assimilated. At the present time, this picture consists of a most interesting outline drawing, with here and there small patches of detailed work, representing considerable acquaintance with some of these methods of plant syntheses and animal analyses. Now we owe it to the work of Fischer, Abderhalden, Hopkins, Moore, Baly and a few other brilliant chemists and bio-chemists that this new knowledge is available and ever growing. Foods consist in the main of three kinds of nutrients:

(1) *The Proteins*—nitrogen-containing compounds, of which white egg-albumen and lean meat are types; these compounds are usually termed the *tissue builders*, though recent knowledge shows they have wider properties;

(2) *The Carbohydrates*—the starch and sugar groups of nutrients, represented by the cereal foods and potatoes, and by cane and other sugars. When these food-nutrients are broken down in the animal body, certain of the degradation products are used by the body to form *fats*. This is the basis of the scientific and inexpensive method of fattening animals by feeding carbohydrate foods in liberal quantities, and whilst the carbohydrates may replace "fat" to a large extent in animal diet in this way, they may, like fats, be stored up in the body for future use as *fuel*, and for energy-production;

(3) *The Fats*—typified in the fatty portions of meats, in butter, etc. In addition to these three main classes of nutrients, water, salts, and vitamins are also of importance.

The *proteins* and *carbohydrates* have occupied the attentions of many chemists for years, since these nutrients are complex in their constitution, a thorough elucidation of which would yield important results. Here the chemist has already made valuable contributions to our knowledge.

Importance of Protein Constitution

Considering first the proteins or nitrogenous class of nutritive substances—these have been proved to be closely-related compounds, consisting of aggregations of simpler bodies known as *amino-acids*, this term denoting substances having typical acid constitution, combined with an ammonia-molecule residue. The proteins can be split up by the chemist, and are split up by the animal mechanism, with the result that these amino-acids are detached from their combination in the molecule of protein. This process takes place in the animal intestine, and it has been shown that the body never uses proteins as such, nor even albumoses nor peptones, which are their first products of digestion, but in all cases the liberated amino-acids only. When it was further shown that all proteins, although agglomerates of amino-acids, do not contain the same amino-acids, nor in similar proportions, the individual amino-acid became of first importance; and we now know that all the amino-acids found in protein molecules are not equally valuable, nor necessary to man and animals, for nutritional purposes; but that some are relatively unimportant, while others are very necessary to our well-being. Variety in diet is therefore seen to be essential, so that we may obtain a due proportion of the important amino-acids, and it would appear that it is more rational for the normal healthy man to be a flesh-eater rather than wholly vegetarian.

Plant-Synthesis of Carbohydrates

Passing now to the carbohydrates of foods—represented by the starches and sugars—it is known that these are in part the result of the decomposition of proteins in plants, but another explanation of their origin has lately been strengthened by much new evidence. It has long been thought that the carbohydrates of plants are synthesised from carbon dioxide and water, taken up by the living plant in the presence of sunlight, and that formic aldehyde represented the first stage of this synthesis, when condensation took place, sugar being formed. But it has never been possible to detect any trace of this aldehyde in the living plant-cells, and indeed its presence as such is scarcely to be expected, as it is a cell-poison. Recent work by Willstätter, Moore, and Baly, especially that of the last-named chemist, has shown that the green chlorophyll of the plant-leaf, in absorbing visible sunlight, uses a part of this energy only for bringing about the initial stage of the synthesis, formic aldehyde being produced by the aid of short-wave-length light; in the second stage of the reaction, the carbohydrate (sugar) is formed by polymerisation of the aldehyde under the influence of the long-wave-length light.* Although these experiments have at present only a theoretical importance, yet, taken in conjunction with our new knowledge of the constitution of proteins, they seem to present a very practical point of interest. This work adds substantially to our knowledge of the origin and make-up of the bodies found in the vegetable and animal kingdoms; and consequently the time is brought appreciably nearer when the bio-chemist may be able to make artificial foodstuffs of true nutritive value. Should this desirable result ever be obtained, the knowledge gained will at least be of very real value in times of famine and other emergencies.

* Baly and Heilbron, *Journ. Soc. Chem. Ind.*, 1921, R., p. 277.

The Problem of Solution

An Extract from "The Compleat Chymist": Being a Conference betwixt a Chymist, a Farmer, a Brewer, and His Friend

A manuscript of great interest has reached us from an author, designated Dr. B. Lagueur, who has cleverly cast into the form of a way-side discussion between the four characters named a critical examination of the latest phases of the problem of solution. The style is founded on that of "The Compleat Angler," and the following fragment is taken from the discussion. The Chymist, the Farmer, and the Brewer meet one fine morning, and over a friendly glass or two exchange confidences as to their respective callings. Presently they are joined by the Friend, who has come to advise the Brewer respecting a sample of water which had been sent to him. The Friend is asked if he is ready with his advice, and replying that, indeed, he is, the discussion turns at once on the problem of solution, and proceeds as follows :—

FRIEND.

I FOUND the water had rather more salt in it than I expected. So that the Chymist may understand me, I tell him that there is an undue concentration of sodium and chlorine ions therein.

CHYMIST.

Stop, I beg you, a moment. Have you seen any of these ions ?

FRIEND.

Indeed they are too small to be seen, sir, by the naked eye or any microscope.

CHYMIST.

Pray, how do you know they are there ?

FRIEND.

My friends, who have taught me such chymistry as I know, tell me that all things dissolved in water are broken up into minute particles which move about in the water with measurable rapidity, and these particles they call ions. Have you not heard of these, sir ?

CHYMIST.

Heard of them ! I am sick unto death of hearing of them. Mark you, young man, if ever you come across a book which expounds this folly, commit it to the flames, for it is naught but sophistry and illusion. I am grateful to the Rhinelanders for they have good beer and good wine, but they worship false gods. I mean chymical gods. Arrhenius would have been a good man had not that arrant knave, Ostwald, praised him, twisted his doctrines out of the path of truth, and spoilt not only Arrhenius but also modern chymistry.

FRIEND.

If an error has been made cannot the subject be leavened with a little truth ?

CHYMIST.

The whole of the Rhinelanders' ideas on Solution are bad from the beginning. *Ab ovo usque ad mala*, as they say. And you can no more leaven them with a little truth than you can sweeten a waggon load of manure with a pot of marmalade.

FRIEND.

These Rhinelanders' ideas on solutions—did they begin bad or grow bad ?

CHYMIST.

They are like nonconformists or members of a publication committee—they are born bad and they grow worse. I trust you have not wasted much time over this foolishness. Ostwald and his brother criminals might have been decent men but for this scourge, which has led almost all astray. When I see any of these on the way, as they all are, to the scaffold or the asylum for lunaticks, I say to myself, "There, but for the Grace of God, goes Henry." For you should know, sir, I was baptised Henry. But when you were told of these ions, did you hear any reasons or so-called proofs that these things do verily exist ?

FRIEND.

Oh, yes ; they not only gave me many reasons, but they told me that chymists throughout the world, except in France, were satisfied that these reasons were sufficient.

CHYMIST.

The French are a logical people and they have a good taste and nicety in these matters. Lavoisier and Pasteur are as great names in this science as are Laplace and Descartes in the mathematicks. But tell me these reasons which they brought forth.

FRIEND.

They told me that one Blagden, about the time of the French Revolution, was the first to look carefully into this problem ; that he dissolved various substances in water and then found out by a thermometer the temperature at which the solution would freeze. He found that the solutions he studied in this way all froze at a rather lower temperature than did water, and the more of any substance was dissolved the lower was the temperature at which the solution froze. Indeed the difference between the freezing point of water and the freezing point of the solution was in exact proportion to the amount of the substance dissolved in the water. They told me that these experiments of Blagden remained almost forgotten until the time of the Franco-Prussian war, when attention was directed to them, and very shortly afterwards one Raoult wrote some memoirs on the matter and made sundry experiments, the results of which he published therein. He confirmed the simple proportion found by Blagden provided that the solutions are fairly weak ones, and he made a further discovery, as follows : If you take a dozen bottles each containing the same quantity of acetic acid and then dissolve in one a small quantity of camphor, in the others small amounts of picric acid, phenol, quinine, acetate of potassium, chloride of tin and such substances, and if you choose your amounts so that they are in proportion to the molecular weights of the camphor, picric acid, and so forth, then these solutions will all freeze at the very same temperature, which is rather a lower temperature than acetic acid freezes at. A similar result is got if you take benzene, nitrobenzene, or water in place of acetic acid, although you may have to choose here and there some other substance to dissolve in these latter liquids. Do you agree with this so far ?

CHYMIST.

I do not call it far, at all, but let that pass. This work of Raoult was merely an extension of the earlier work of Coppet, who, in 1871, pointed out what you have just stated. Raoult's work was fuller and more detailed. But your teachers did not, I suppose, claim that all substances obeyed these rules of Coppet and Raoult ?

FRIEND.

By no means. In dissolving substances in water, they told me that the usual acids such as hydrochloric acid and sulphuric acid, and the chlorides, sulphates, nitrates, acetates and other salts of the usual metals did not conform to this rule, but that the freezing point of the solutions of these acids and salts was lowered by about twice as much as was laid down by the formula of Raoult. They concluded from this that the molecules of hydrochloric acid, potassium sulphate, and so on, were split into two parts, each of which could lower the freezing point as much as a molecule ; they said these parts were ions and they told me this was called electrolytic dissociation or the ionic theory.

CHYMIST.

Did you believe them ?

FRIEND.

Why, yes.

CHYMIST.

I have not found such great faith, no not in all Israel. Ionic theory ; you should rather call it the tommy-rotic theory.

FRIEND.

But do you not think the ideas of Van't Hoff support this theory ?

CHYMIST.

How so ?

FRIEND.

Why, substances dissolved in a liquid in some cases can travel through a membrane, and they always diffuse them.

selves about as the result of an internal pressure called osmotic pressure. Now Van't Hoff came to the conclusion in 1887 that the laws of osmotic pressure for dilute solutions correspond very closely with the laws for the pressure of ordinary gases, and he calculated that the osmotic pressure of a substance in a dilute solution is equal to the pressure the substance would exert if it were converted into a gas at the same temperature as the solution and could be made to occupy the same volume as the solution. Now these salts, which dissolve in water and lower the freezing point to a greater degree than is foretold by the formula of Raoult, all have correspondingly great osmotic pressures, greater, that is, even twice or thrice as great as can be expected from the number of molecules which you can calculate as present in the solution. To explain this Arrhenius assumed that each molecule of such a substance breaks up into two or three ions or as many ions as the pressure requires, and that each ion has the same effect so far as osmotic pressure is concerned and so far as freezing points are concerned as if it were a whole molecule.

CHYMIST.

I am glad our good hostess here does not sell her ale on this theory. If I asked for a pint and she gave me half a pint and told me I could divide it into two parts and assume each part was as potent and chearful as the whole, I should move on to another hostelry.

FRIEND.

But Arrhenius does not quite do this.

CHYMIST.

He doesn't do it so openly. He and his followers obscure their assumptions by clouds of algebra and calculus, just as a conjurer distracts your attention by amusing patter at the very moment you ought to keep your eyes fixed on his deceitful hands. But if one is permitted to cut your molecule, as Werner proposes, into complex ions, and then cut up the complex ions into simple ions and give each simple ion the same physical powers as the original molecule there will be no need for exact experiments. You can justify any set of figures by such jugglery. But tell me, on this ionic theory, do the figures—with the assistance of this sort of fairy wand of Arrhenius—fit in with the results which are known?

FRIEND.

Pretty well, so they tell me. But in some cases you must assume that the ions are each combined with some molecules of the water in which they move about, and in other cases you must assume that the molecules are some of them dissociated into ions and some of them are not so dissociated, and you must sometimes assume that the molecules not dissociated are combined with the water they are dissolved in. These ideas are supported by Walker, McIntosh and some other Scotsmen, and the Scots are a cautious nation. Moreover, Lowry adheres to these and he is a Professor at Cambridge.

CHYMIST.

Lowry only partially accepts the theory of ions. You must give me more powerful reasons than before; rather more proof and rather less assumption.

FRIEND.

I will do my best, but indeed the theory seems better and more logical when you read it in a book. I cannot do justice to it.

CHYMIST.

A theory that cannot be discussed and must be read in a book is a poor sort of theory. I fear that your "frail thoughts dally with false surmise," as Milton says.

FRIEND.

This combination of molecules with the liquor in which they are dissolved is called solvation or hydration.

CHYMIST.

For heaven's sake call it anything you like, but first prove to me the combination exists.

FRIEND.

Look you, sir, the speed with which the ions move in a solution can be calculated by mathematicks. These speeds are small, only a few centimetres per hour, and the more dilute the solution the quicker the speed. These speeds have also been directly measured by Whetham, Steele, Lewis and others. It is found, for instance, in the case of the alkalis, that the ion of sodium moves half as fast again as the ion of lithium, and the ions of potassium, rubidium and cæsium move about twice as fast as the ion of lithium. Now one would expect the lighter ion to move more quickly than the heavier one, and indeed this can be proved from the study of diffusion. And the only explanation of the greater speed of the cæsium ion than that of the lithium ion is that the lithium ion is combined with more molecules of water than is the cæsium ion.

CHYMIST.

What is the use of splitting up your sodium chloride molecule into two ions to make your theory fit the facts of freezing points, if you have to combine your sodium ion with a few molecules of water in order to make your theory fit some other facts?

FRIEND.

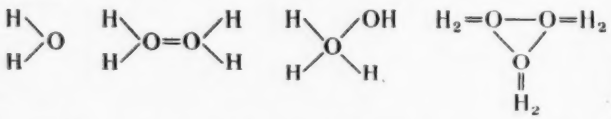
This theory agrees well with the facts of electrolysis, and you surely do not doubt the results of Faraday and the electricians who learned from him. According to Hudson and some of the other American chymists even pure water in a jug undergoes some little dissociation, and the presence of a few oxygen and hydrogen ions accounts for the conductivity—small as it is—of pure water. A theory which accounts for so much must have something behind it even if some of the details are not quite proved according to the strictest ideas of evidence. The views of Arrhenius and Van't Hoff receive confirmation from the study of gases. We know that many vapours, when the temperature is raised, undergo some sort of dissociation into atoms and the ions are only electrified atoms. What goes on in a state of vapour may easily go on in a state of dilute solution. And, sir, pray tell me why all dilute solutions of cobalt salts are pink? I say they are all pink because they all contain cobalt ions and cobalt ions are pink. So, too, all solutions of copper salts, I mean dilute solutions, are blue because they all contain copper ions and these are blue.

CHYMIST.

I do not know why copper salts are blue, nor why ultramarine is blue, nor why red-lead is red. But do not ask me to dissociate the molecules in order to explain the conductivity of water and the blue colour of copper salts. Let me tell you some facts and give you a reasonable explanation of them. You have touched on a variety of matters, and some of these are complicated and difficult. You have spoken of Faraday and electrolysis. Now the ions you speak of are merely electrified atoms or groups of atoms, and whether they exist in dilute solutions or not, or are concerned in electrolysis, we may as well know some of the elementary facts. Electrical attraction was suspected by Sir Isaac Newton to be the same as chymical attraction, and Sir Humphry Davy, in his books published in 1807 and 1812, was more definite on this point. Berzelius, a little later, wrote a good deal on the connection between electricity and chymical activity, but he finally lost himself in a maze of false assumptions when he got away from his general idea, which was a sound one. Now we come to Michael Faraday, a man to be relied upon. It is eighty or ninety years since Faraday performed his experiments, but his results stand to this day. Faraday proved that when you decompose a substance by passing an electric current through it, the amount of substance decomposed is in exact proportion to the amount of electricity flowing through. If you pass the same electric current through solutions of silver nitrate, copper sulphate, gold trichloride and tin tetrachloride, you will deposit in the same time 108 millegrams of silver, 31·8 millegrams of copper, 65·7 millegrams of gold, and 29·8 millegrams of tin. These metals have valencies of 1, 2, 3 and 4, and if you multiply the weights mentioned above by the numbers 1, 2, 3 and 4 respectively, you get the atomic weights of the metals. This electrical property and the chymical combining weights are the same for each element. Our modern views of atoms in which the valency of each atom depends on the number of units of negative electricity in the external sphere of the atom, is a direct consequence of this law of Faraday. Faraday called bodies which travel to the cathode, cations, and bodies which travel to the anode, anions, and each of these he called ions, and he did not assume, nor is there any need to assume, that these should be electrified either in considering electrolysis or in solution. Fitzgerald has shown that the idea of Grotthus of a chain of polarised molecules, published so long ago as 1805, will, with a very slight modification, account for the phenomena of electrolysis. We have no reason to think that Faraday, if

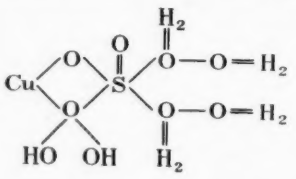
he had lived to this day and retained his faculties, would have taken to the wild assumptions of Arrhenius and Ostwald. The atom with an electrical charge on it plays an important part in radioactive bodies, as Soddy and others have shown, but the word ion as used by Faraday does not mean an atom with an electric charge on it. Now, as to the conductivity of water; the purer you get your water the less does it conduct electricity. Water dissolves air, glass and other substances, and is, therefore, easily contaminated. The smallest quantity of impurity makes it a conductor. Pure water in the liquid form has not been seen; pure ice is a non-conductor of electricity, and we can get water so pure and so little a conductor that we are justified in stating that if we could get absolutely pure water in a liquid form it would be a non-conductor.

Now let us consider a little the chymistry of water. I will call your attention to the experiments of Tamman and Bridgman on the different varieties of ice. These experiments were made ten or twelve years ago, but they have not been challenged—they seem to show that ice exists in different allotropic forms; that is to say, some are more complex in their molecules than the others. Some of these varieties of ice must therefore have molecules or agglomerations of atoms containing more than two atoms of hydrogen and more than one atom of oxygen. Bragg has worked out the structure of ordinary ice by means of the reflection of X-rays, and he shows that ice has, as might be expected from its crystalline form, a structure involving for one unit, twelve hydrogen atoms and six oxygen atoms. Whether molecules as such exist in ice is not certain, what is certain is that two atoms of hydrogen and one atom of oxygen could not form ice. Ice is more complicated than that. As the vapour pressure of steam is a little greater than would be expected from a vapour with the constitution H_2O, steam probably contains a few molecules of H_4O_2 or something of that sort. As to water, Thomsen in 1885 showed it was probably complex; Vernon, in 1891, from a comparison of its boiling point with the boiling points of some other liquids, came to the conclusion it was complex. Röntgen in 1892, Van't Hoff in 1900, Sutherland in the same year, and several workers in later years have reasoned similarly. From an examination of the specific refraction, of the phenomena of evaporation and other data, this view is confirmed by many. Water is without doubt a mixture of a number of substances of the general type $(H_2O)_n$, wherein is some small integer. These may well have such formulæ as I now write down:—



Mark you, these formulæ are merely conjectures; that some such polymers of H_2O exist is not to be questioned. There is nothing improbable in giving oxygen four valency bonds; its position in the periodic table, its similarity to sulphur, the structure of its atom as shown by Rutherford, Langmuir and Dauvillier, all prove this to be likely, nay certain.

Water has a considerable power of forming compounds; it is not an inert liquid like paraffin. Three different hydrates of copper sulphate exist, hydrates of sodium carbonate, calcium sulphate and plenty of other salts are known. Water forms a series of compounds with potassium and mercuric chlorides, and I could give you scores of instances. These hydrates are true chymical compounds; we know of only one sort of chymical combination, and this differs in degree, not in nature. We may write alcohol as $C_2H_5(OH)$ and we may write the copper sulphates, if we think fit, as $CuSO_4(H_2O)_5$, $CuSo_4(H_2O)_3$ and $CuSO_4(H_2O)$, but we must remember that the hydrogen, oxygen, sulphur and copper are all combined together in one organisation—we hardly know whether to speak of molecules or not in dealing with crystalline bodies. These hydrates are somewhat weakly held together, and it is not difficult by heat or some other agency to dislodge a couple of hydrogen atoms and an oxygen atom which will leave the system and combine with each other. But mark you, what is called water of crystallisation is as much an integral part of the compound as the rest and is combined in just the same fashion. This is confirmed by the X-ray examination of such crystals by Vegard and Schjelderup. It is not difficult to devise formulæ for such compounds, but it is not very profitable. I put forward one for your consideration, and you may invent plenty of others, but, I beg you, argue not from such speculative premisses. If you admit that water is a mixture of polymers of H_2O, as I think is now pretty well established, and if you admit that these polymers have a great facility for forming rather weak chymical compounds with an enormous number of salts, then, I think, we can get on to my next argument.



Now let us turn to the work of Raoult, and the interpretation of this work and that which has since been done. Raoult wisely chose as his solvents several liquids like acetic acid and benzene, and his results were, for many such, concordant and valuable. The commonest solvent and the one on which most study has been undertaken is water, this exceptional, complex and chymically active mixture of polymers. Here we get, as we should expect, complicated results which show great discord. Raoult found, instead of a constant depression of the freezing point of water for each molecule of the dissolved substance, such results as these:

Phenol	15·5	Potassium nitrate	30·8
Salicin	17·2	Potassium chloride	33·6
Copper Sulphate	18·0	Soda	36·2
Cane sugar	18·5	Lead nitrate	37·4
Formic acid	19·3	Potassium carbonate	41·8
Arsenious oxide	20·3	Potassium oxalate	46·8
Oxalic acid	22·9	Strontium chloride	51·1

Now I defy you to find any consistent formula connecting these figures, and no one who duly appreciated the nature of water would attempt one. There is no consistency, because you are not dealing with a uniform solvent. The various polymers of H_2O, whether you call them hydrone, or dihydrone, or by any other names, are easily converted into other polymers. If you introduce a crystal of copper sulphate or soda into such a liquid, action takes place between the two; not only is the crystal affected but the solvent also. This is generally true of water, and we do not yet know, nor will it be very easy for us to know, what is the proportion of these polymers in pure water at a given temperature, nor how these are further polymerised or split up by the addition of various substances. But we do know from the work of Faraday that electrolytes are the substances which are most chymically active. It may be true that electrical change and chymical change are identical. It is certain that a chymical force may be balanced by an electrical one, that chymical change may be checked or induced by electrical action; that the two are intimately connected. Ostwald has compared, in considering solutions in water, the equilibrium between various salts mingled with not one solvent but an infinite number of different solvents whose exact composition we know not. Do not build too massive a structure on so precarious a foundation. Form as many theories as you please, think over the problem and perform experiments. But keep your mind open as well as your eyes. This idea of dissociation has no basis of fact to support it; it is pure assumption from beginning to end, and it has long outlived its usefulness, if, indeed, it ever had any.

FRIEND.

But do you not think there is something in it; a great probability that some part of it is true?

CHYMIST.

I do not think that any part of it is true. Some parts of this theory I think can be positively disproved; the remainder I believe is entirely without foundation and false. I think the explanation these ionists give of solution, of electrolysis, of osmotic pressure, and of chymical change is misleading and doing great harm to the young students. Some day all these ideas and the jargon in which they are expressed will be as out of date as the doctrine of phlogiston. That was a useful idea for a few years; it made people think. A brain which evolves a false idea is better than a brain which cannot evolve any idea.

FRIEND.

But, tell me, is not a dilute solution of a mixture of magnesium sulphate and potassium chloride identical with a dilute solution of a mixture of magnesium chloride and potassium sulphate ?

CHYMIST.

Indeed it is, and so is a strong solution. This is not due to the presence of ions ; even you ionists do not consider that strong solutions are much dissociated. These solutions are identical because the two salts and the water all act on each other ; they quickly establish an equilibrium and form a mixture of a great variety of solutions. You will find, as E. F. Armstrong showed some years ago when he was but a lad, that you obtain solutions of magnesium sulphate and magnesium chloride, potassium sulphate and potassium chloride, double sulphates and a very complex mixture indeed. You can crystallise out all kinds of queer things in turn from such mixtures. When one of such compounds is insoluble it is precipitated and its influence goes ; your equilibrium is not restored until as much of the insoluble compound is formed as can be formed, and is precipitated and got out of the way. But a precipitate is merely an outward and visible sign, there are thousands of chymical changes going on when you mix solutions together of which nothing is perceptible by the human eye.

BREWER (*intervening*).

You both look tired by your talk. Have you settled the matter in issue ?

CHYMIST.

I rather think your friend sees some force in my arguments.

FRIEND.

But my theory has led to some very fruitful results. I must try and think of some objections to your reasoning. I hope my theory is true.

BREWER.

If a theory lead to useful results, is it of much importance if it is true ? All my life people have been telling me of new theories which have helped them to understand what goes on in nature and to predict new facts. Many of these theories have turned out to be false. As a brewer, I have been much exposed to scientific people, chymists, biologists, bacteriologists, and all the other 'ologists. I take all these theories but as tools, to be used so long as they are useful and to be thrown aside so soon as a better comes along. I have seen in the papers a theory about the ether ; now all the talk is about a theory of relativity ; in a few years time a new theory will come along, better than this one of Einstein. I am a practical man and do not understand all your talk, but the looker-on sees most of the game, and when you have seen as much of the world as I have you will agree with me that you scientific people have a lot to learn before you can grow barley, make malt, or brew ale. Your theories only take you part of the way, and the ways of Nature are too intricate for you to follow. Come now, a rest from these matters.

Protecting the French Dye Industry

QUESTIONED recently on the protection granted to the French dye industry, the French Minister of Commerce stated that the dye and chemical industry in France has not been subsidised, either directly or indirectly, by the State. But in order to give the necessary protection to a national industry a law was passed on November 7, 1919, by which a certain tariff was applied to French chemical products and dyes, allowing for the difference in the cost of French production and foreign production. Commenting on this reply the Paris correspondent of the *Financial News* states that since then this tariff has been readjusted by certain increases. On the other hand, this same law regulated the entry into France of dyes and colouring matters, which Germany was to deliver under the Treaty of Versailles, in such manner to assist home production without damaging the interests of home consumers. Moreover, in order to prevent fraud and to enable the realisation of the Government's protection plan, the import of those dye products entering France under the heading of deliveries in kind must be sanctioned by the Ministry of Finance, in agreement with the Office of Chemical and Pharmaceutical Products.

The Fine Chemical Industry

Effects of the Safeguarding of Industries Act

PRESIDING on August 24 at the twenty-fifth annual meeting of W. J. Bush and Co., Ltd., held at the Abercorn Rooms, Great Eastern Hotel, Bishopsgate, London, Mr. J. M. Bush (chairman) recalled that at their last meeting he had referred to the depression in trade from which the country was suffering, and to the loss that the company had sustained through depreciation in the value of stocks. He had said, further, that those adverse conditions unfortunately still prevailed. While the decline in values continued, buyers naturally held off the market, with the result that the company's turnover fell and became disproportionate to the cost of their organisation. There was no alternative but to reduce expenses, a difficult and unpleasant task, and one that took time to effect.

The problem was : Whose services were to be dispensed with ? At what point in the interests of commercial self-preservation was one justified in putting out of employment those who had given faithful and loyal service in times of prosperity ? Was it wise when trade depression occurred, the duration of which no one could foresee, to disperse men whom it had taken a long time and considerable expense to train ? These were very difficult problems to solve, and in exercising its judgment the board had possibly erred in the direction of holding the staff together and retaining the services of men for whom there had been insufficient work.

The board were postponing action in many cases in order to see what effect the Safeguarding of Industries Act would have upon their industry. This Act (continued Mr. Bush), had not been in operation long enough for them to form any decided opinion as to whether it would successfully achieve its purpose, namely, to establish on a firm basis in this country a well-developed fine chemical industry. If not actually born during the war period, this industry had to be greatly expanded during that time in the interests of national defence.

Beneficial Operation of the Act

The beneficial operation of this Act (said Mr. Bush), had been greatly hindered by the abnormalities of foreign exchanges, the fall in the German mark having led to prices being quoted from Germany with which, notwithstanding the import duty, it was impossible to compete. But apart from this, the confidence of manufacturers had received a rude shock by some surprising decisions which had been given in cases where the correctness of the inclusion of certain chemicals in the list prepared under the Act had been challenged.

According to these decisions, manufacturers of fine chemicals, and chemical merchants found to their astonishment that for many years their customary classification of some of their products in their price lists had been incorrect, while the same applied to the market reports of trade journals. The consequence was that much bewilderment prevailed, and the fine chemical manufacturer was left in doubt whether if he expanded his manufacturing operations he would be safeguarded under the Act. Still, in certain directions, the benefit of this Act had been distinctly felt, and it had undoubtedly enabled them to keep men at work, and parts of their factories moderately busy.

Dealing with the financial position of the company, the chairman said that since the revaluation of their stocks at prices which appeared to be fairly well stabilised, there were indications that the company was again on a profit-earning basis. Their bank loan had been reduced by £25,000 since the beginning of the year, notwithstanding an increase in turnover. If their claims to a refund of excess profits duty and to a re-assessment for income tax received the treatment to which they considered they were entitled, the greater part of the amount carried forward to the debit of the profit and loss account would be wiped out. They hoped, therefore, that it would not be long before they could resume paying dividends on their ordinary shares.

The conditions prevailing in the United States during the past year were practically identical with those in England, and their American company also experienced a loss. The deficit was, however, within the limits of the surplus carried forward. Their Canadian company made a small profit. In both Canada and America their trade had improved during the current year.

Reviews

PROTEINS AND THE THEORY OF COLLOIDAL BEHAVIOUR. By Jacques Loeb. London: McGraw-Hill Publishing Company, Ltd. 1922. Pp. 292. 15s.

The introduction of accurate methods of determining hydrogen-ion concentration has shown that proteins combine with acids and alkalis in definite proportions, and so obey the ordinary laws of chemistry—in other words, the chemistry of proteins, the typical "colloids," does not differ from the chemistry of "crystalloids."

In this arresting and timely book the author submits, in the first part, the proof that the reactions of the proteins conform to well-known laws; and, in the second part, he develops a mathematical and quantitative theory of colloidal behaviour on the basis of Donnan's theory of membrane-equilibria, which Proctor and Wilson have successfully applied to the problem of the swelling of gelatin in acid. It follows, according to our author, that Freundlich's formula of the adsorption of electrolytes on the surfaces of colloidal particles is no longer tenable, at least so far as the proteins are concerned. Indeed, Langmuir and others have proved that this empirical adsorption formula does not hold even in other cases.

Donnan has shown that when a membrane separates two solutions of electrolytes, one of which contains one ion which cannot diffuse through the membrane while all the other ions can, the result will be unequal distribution of the diffusible ions on the opposite sides of the membrane. At equilibrum the products of the concentrations of each pair of oppositely-charged diffusible ions are the same on the opposite sides of the membrane. This unequal concentration of crystalloidal ions must give rise to potential differences and osmotic forces, and in this volume the author gives proofs of the sufficiency of these forces to account for colloidal behaviour.

The book, which is excellently printed and produced, and remarkably free from accidental errors, contains a valuable historical introduction of 26 pages, and copious references to the literature are given throughout the work. It should be in the library of every organic chemist.

A. R. T.

A SYSTEMATIC QUALITATIVE CHEMICAL ANALYSIS. By George W. Sears, Ph.D., Associate Professor of Chemistry in the University of Nevada. London: Chapman and Hall, Ltd. 1922. Pp. 119. Price 8s. 6d.

The title-page describes this book as a theoretical and practical study of analytical reactions of the more common ions of inorganic substances. In the first part of the book the author discusses the Ionic Theory and the Law of Mass Action. In the second he gives methods for the systematic analysis of the cations or metal ions by the usual process of precipitation by group reagents. The third section deals with the anions or acid ions, and describes a new systematic method for their identification. A preliminary group classification is adopted as in the case of the metals. There are four groups. The first includes anions whose silver salts are insoluble in cold dilute nitric acid, the second those whose salts decompose in boiling acid solution and give characteristic volatile oxides, the third those whose silver salts are soluble in acid but insoluble in warm neutral solution, and the fourth those whose silver salts are soluble.

The book is a useful compilation and gives a clear description of the theory of ionisation and of associated theories, and it should be valuable to students who have reached an advanced stage in the study of chemistry. Young students, and those who have only an elementary knowledge of the science, will probably find the theories difficult to understand and may make better progress in learning how to conduct qualitative analyses with the aid of books which give little consideration to the ionic theory. The addition of an index would make the book more useful to those who may have occasion to search its pages for information concerning the identification tests for any specified metal.

H. F. H.

LABORATORY EXERCISES IN INORGANIC CHEMISTRY By JAMES F. NORRIS and KENNETH L. MARK. London: McGraw-Hill Publishing Company, Ltd. Pp. 548. 10s.

This book on elementary practical chemistry is written by two well-known American professors. It is clearly written, well-printed, and interleaved with blank pages upon which the student is expected to make notes; there are, therefore, only 274 pages of type. A discussion on the problem precedes each experiment, and the experimental work and reading are arranged so as to run concurrently. This plan is excellent, but the authors only half believe in it; they state in their preface that the questions in each chapter have been selected in such a way that it is "necessary for the student to read the discussion in order to answer them." Surely it would be better to select the questions so that it is necessary for the student to perform the experiment in order to answer them. It is a pity that the authors have not sufficient faith in their method to adopt it wholeheartedly and allow the students to reason a little more and be helped unobtrusively to see what the experiment proves after it has been made.

The book is so good that it ought to reach other editions, and the responsibility of the authors towards the younger generation is accordingly great. Here and there the authors prejudice or bias the mind of the student, before the experiment is made, in a wholly unnecessary manner. The chapter on solutions is a flagrant example of this. To mix up assumptions, opinions, and facts as the authors do, and then require the student to perform a few elementary experiments which will probably make him think he has proved the hypothesis, is not fair to the student. It neither teaches him how to think, how to reason, nor how to learn the truth of this complicated and difficult problem. If the problem is beyond the reasoning powers of the student—as is quite possible—it should be let alone.

M.

Modifications in the Basic-Bessemer Process

REFERRING to the fact that the company's importation of foreign ore had ceased, Sir Frederick Mills, who presided on Tuesday at the annual meeting of the Ebbw Vale Steel, Iron, and Coal Co., Ltd., said that they were now working wholly on Northamptonshire ores and this had involved a change in their steel-making processes. They had adopted a modification of the Basic-Bessemer process as being the most suitable. A change-over of this character, on so large a scale as they usually operated could not be accomplished all in a moment, and must be accompanied with some expense. Accordingly, the board had proceeded along the line of rather proving the process than of endeavouring to achieve a large output, which, under the conditions ruling, would have been difficult to dispose of. The by-product coke oven plant at Ebbw Vale had now a capacity of 11,000 tons a week, probably the largest in the kingdom, and the two new blast furnaces were in every way remarkable. The first of them was tested in the manufacture of hematite pig-iron, and produced as much as 3,039 tons in one week, which the directors believed to be the largest output of hematite in this kingdom, and since turning to the manufacture of basic pig-iron the maximum output so far has been 1,741 tons in one week, which is believed also to be the largest output of pig-iron made from Northamptonshire ores, and considerably in excess of that for which the furnace was designed. Hitherto they had sought rather to prove the process metallurgically, and that they had done; they now proposed to test it commercially.

The Manufacture of Fertilisers

To the Editor of THE CHEMICAL AGE.

SIR,—I received a letter recently from a foreign correspondent drawing my attention to an article by Mr. L. Carpenter in THE CHEMICAL AGE of May 13 on the manufacture of fertilisers. I was asked whether American practice, as stated by Mr. Carpenter, calls for only one-half the sulphuric acid used in English or European practice, and whether American superphosphate is mainly di-calcic phosphate. As Mr. Carpenter's statement may have been accepted by many of your readers, I think some correction is necessary.

It is true that in the United States sales of superphosphate are made on a basis of "citrate-soluble" P_2O_5, but the citrate soluble figure is not an indication of the di-calcic phosphate content. A 16 per cent. citrate soluble usually analyses 15 per cent. water soluble P_2O_5—in other words, over 90 per cent. of the citrate soluble is water soluble.

Reactions 4 and 5 as given by Mr. Carpenter are theoretical possibilities; but, in practice, as any manufacturer carrying out close analytical checks well knows, the use of less than the amount of acid necessary to give mono-calcic phosphate does not give di-calcic phosphate, even on long standing. Half the amount of acid (of the usual strength) will give mono-calcic phosphate and undecomposed rock, and even the suspension of such a mixture in water does not give rise to di-calcic phosphate in appreciable amounts, except under special conditions of temperature and pressure.

American practice in superphosphate mixing is similar to English practice as regards ratio of rock to acid, but the American maker through the use of a citrate soluble P_2O_5 figure receives payment for all the "dissolved phosphate," including the small percentage of di-calcic phosphate resulting from the reversion of mono-calcic phosphate by iron or by pressure in the storage piles.

It is customary to quote export business on a water soluble basis; so, granting Mr. Carpenter's ideas on the American acid-rock ratio, it would be necessary to manufacture a special export material, instead of shipping from stock as is actually the case.

Undoubtedly, as Mr. Carpenter says in his opening paragraph, there is a lack of literature on the manufacture of fertilisers, and for this reason it is a matter of regret that an article as interesting as Mr. Carpenter's should contain a serious mis-statement.

I am enclosing copy of an article from the *American Fertiliser* in which I dealt with some phases of manufacture which needed research and publication of results.—Yours, etc.,

A. E. MARSHALL, Chemical Engineer.

3034, St. Paul Street, Baltimore.
August 15, 1922.

[COPY.]

The Chemical Process of Acid Phosphate Manufacture

By A. E. MARSHALL.

THE manufacture of acid phosphate through the interaction of phosphate rock and sulphuric acid is a definite chemical process, much simpler than the average run of processes involved in the chemical manufacturing industry.

In the early days of fertiliser manufacture plants were run by rule of thumb, without any attempt at chemical control. Even to-day a large majority of plants operate along certain fixed lines, without attempting to discover the scientific reasons for these methods or the possibility of making improvements.

Other industries, with much smaller yearly values of output, have in recent years reached a high standard of development, through research and study of the processes and plant employed. There is a definite need for thorough and complete research on acid phosphate manufacture, and a dissemination of the knowledge so obtained.

Fertiliser manufacture occupies an important position in the list of American industries, but it is unique in its lack of literature on manufacture. Even universities which give excellent courses in chemical manufacture and chemical engineering, generally devote such scant attention to fertilisers in lectures that their graduates lack even a speaking acquaintance with fertiliser manufacturing processes.

The reason for the present state of scientific knowledge on phosphate manufacture undoubtedly rests with the manufacturers. They have grown up in an industry which was capable of giving certain results without any expenditure on research, or any form of control other than a hydrometer and an analysis of the phosphate rock. A certain air of mystery generally surrounds a rule of thumb job, and one finds in fertiliser manufacture a jealously guarded "trade secret" in common use, although each manufacturer believes he has something entirely different and superior to his competitors.

The sulphuric acid industry is just emerging from a similar phase, and as a result progress is being constantly recorded in the problems of manufacture, and is finding its way into a permanent and valuable place in the literature of the manufacturing arts.

In the fertiliser industry to-day there are few of even the large acid phosphate producers who can supply anything more than an answer based on tradition to questions involving the chemical or physical aspects of their processes.

The development of fertiliser machinery has made great progress in recent years, because the machinery manufacturer is able to make improvements on the basis of knowledge acquired through failures or difficulties in the factories using his equipment. The equipment manufacturer disseminates information on the possibilities of mechanical operation, and so gradually improves this side of the process, but the chemical and physical aspects are voiceless and therefore stationary.

A study of the variables in phosphate manufacture suggests some useful lines of research for our universities and the large manufacturers. As an indication of possible studies, the following list is of interest:—

1. Influence of the composition of phosphate rock on the finished product, with particular reference to the problems of reversion.
2. The proper fineness of grinding of the rock to secure perfect mechanical condition in the acid phosphate.
3. The relation between fineness of grinding of rock and final composition of acid phosphate after curing.
4. The desirable strength and temperature of acid to be used for the production of (*a*) high available and low insoluble phosphate, and (*b*) water soluble phosphate.
5. The period of mixing for various finenesses of rock, and the desirable CO_2 losses (for rock containing carbonate) in the mixing processes.
6. The time of intimate contact of the mixed acid and rock under the conditions of heat and pressure which occur in the "den" or equivalent device.
7. Influence of depth of storage piles on composition and mechanical condition.
8. Changes which result from various methods of aerating stored acid phosphate.
9. Improvement of mechanical condition and composition through addition of acid-neutralising materials at various stages of storage.

If fertiliser manufacture is to take its proper place as one of the chemical manufacturing industries, and is to keep a forward state of development, research is necessary, and the results of such research must be made available through publication. The progress made by other industries which have swept overboard the ancient traditions of secrecy, and have inaugurated joint researches and open discussions of manufacturing processes, is a sufficient indication of the value of the "open door."

Corrosion of Metals by Acid Mine Waters

IN the course of the general investigation of metal corrosion by mine water, being conducted by the U.S.A. Bureau of Mines at Pittsburgh, Pa., a study has been undertaken of the microscopy of corroded metals and alloys for the purpose of examining the preferential and differential corrosion of constituents in alloys under the action of different corroding media.

Colloid Chemistry and its Industrial Applications

THE following is a Summary Report of the British Association Committee (Professor F. G. Donnan (Chairman); Dr. W. Clayton (Secretary); Dr. E. Ardern, Dr. E. F. Armstrong, Sir W. M. Bayliss, Professor C. H. Desch, Dr. A. E. Dunstan, Mr. H. W. Greenwood, Mr. W Harrison, Mr. E Hatschek, Mr. G. King, Professors W. C. Mc.C. Lewis and J. W. McBain, Dr. R. S. Morell, Professors H. R. Proctor and W. Ramsden, Sir E. J. Russell, Mr. A B. Searle, Dr. S. A. Shorter, Dr. R. E. Slade, Mr. F. Sproxton, Dr. H. P. Stevens, Mr. H. B. Stocks, Mr. R. Whymper. The publication of the Fourth Report was unavoidably delayed for many months, but it was published in August, 1922, by H.M. Stationery Office. The following papers, eight of academic nature and six on industrial subjects, are included in the Report:

Colloid Problems in Analytical Chemistry. By Professor H. Bassett, D.Sc., Ph D., D. ès Sc., F.I.C. (University College, Reading).—The fundamental colloid phenomena underlying most analytical operations are discussed, especially in connection with the formation, purity, filtration, and washing of precipitates. The colloid properties of the filter-paper, surfaces of vessels, etc., are also discussed. The Report includes a selection of important analytical determinations in inorganic and organic chemistry, illustrating the colloid principles under discussion.

Cataphoresis: The Motion of Colloidal Particles in an Electric Field. By Professor E. F. Burton, M.A., Ph.D. (University of Toronto, Canada).—This paper is a summary of the main points in connection with cataphoresis, and includes recent work carried out in Professor Burton's laboratory on the technique of cataphoresis.

Colloid Systems in Solid Crystalline Media. By Professor Cecil H. Desch, D Sc., Ph.D. (University of Sheffield).—The dispersion of solid particles throughout a crystalline solid, when the state of subdivision is sufficiently fine, introduces colloidal characteristics of interest in metallurgy and mineralogy —*e.g.*, the hardening of steel and of certain iron-ferrous alloys, by quenching from a high temperature, and the colouring matters in crystalline minerals.

Molecular Attraction and the Physical Properties of Liquids. By Edwin Edser, A.R.C.Sc., F.Ph.S., F.Inst.P. (Minerals Separation, Ltd., London).—The law of molecular attraction derived in this paper may be stated as follows: Two molecules attract each other with a force that varies inversely as a power of the distance separating them, and this power must be higher than the fifth. In all liquids the result of analysing the experimental data is to indicate that the molecules attract each other inversely as the eighth power of the distance separating them; mercury, however, is not in good agreement with this law. It is deduced from this law that: (1) Of the energy which represents the surface tension of a liquid, 94 per cent. is located in the surface layer one molecule diameter in thickness, while the remainder is located at a greater distance from the surface; (2) at a distance of one molecule diameter from the surface of a liquid the intrinsic pressure is 8·5 per cent. less than the maximum value in the interior of the liquid.

Membrane Equilibria. By W. E. Garner, M.Sc. (University College, London). The remarkable potential differences occurring at cell surfaces—*i.e.*, at the surfaces of membranes in contact with electrolytes—are discussed in the light of the theories due to Ostwald, Haber and Klemensiewicz, Loeb and Beutner, and Donnan. Special consideration is given to Donnan's theory based on thermo-dynamical treatment.

Disperse Systems in Gases. By W. E. Gibbs, D.Sc. (Chief Chemist, The Salt Union, Ltd., Liverpool). The methods of formation of disperse systems in gases are studied—*e.g.* (1) by the condensation of a gas or vapour in the presence of suitable nuclei; (2) by the disintegration and dispersion of a liquid or solid. Those systems in which the particles are too large to exhibit Brownian motion at ordinary temperature and pressure are termed "clouds," while the more highly disperse systems are called "smokes." The properties of these gas-solid and gas-liquid disperse systems are considered in the following order: (1) their mechanical properties—the concentration, the motion of the particles, and the degree of dispersion; (2) their optical properties—the absorption, reflection, refraction, and diffraction of light by the system; (3) their thermal properties—the absorption and radiation of heat; (4) their electrical properties—the electrical charges upon the particles, their behaviour in an electric field; (5) their chemical properties—the increased chemical activity of the disperse system, due to its high degree of dispersion. The industrial applications are dealt with, and the paper concludes with a section on chemical warfare.

The Theory of Lubrication. By W. B. Hardy, M.A., F.R.S. —"A theory of lubrication must be founded upon a general theory of friction. No such general theory, however, exists, but in its place there is a theory of internal friction or viscosity which refers the resistance to fundamental forces between molecules, and a theory of external or superficial friction which, standing where Coulomb left it in 1781, accepts accidental inequalities of the surfaces as a sufficient cause." The theories of Coulomb, Reynolds, and others are discussed, and a theory proposed, based on molecular orientation in surfaces, according to which one would expect "that in general any good lubricant would be more strongly attracted by the bounding solid faces than a bad one. The expectation can only be a general one, because lubricating qualities depend not only upon the intensity of such attraction, but also upon the kind of orientation of the molecules produced by it, and the variation of potential energy in the lubricant and surface of the solid produced by traction."

The Application of Colloid Chemistry to Mineralogy and Petrology. By Alexander Scott, M.A., D.Sc. (Central School of Pottery, Stoke-on-Trent).—The general principles of colloid chemistry are applied to important phenomena in mineralogy and petrology, and special attention is given to those rocks and minerals which exist in a colloidal form, or are derived from colloidal material. Weathering, cementation, adsorption, ore deposits, concretionary and banded structures, dendritic structures, igneous rocks, etc., are discussed as colloid problems. Rocks and minerals in large number are considered in much detail, and investigations mentioned which are needed to extend our knowledge of the mechanism of well-known natural phenomena.

Colloid Chemistry of Soap. Part II. The Soap Boiling Processes. By Professor J. W. McBain, M.A., Ph.D., and Ernest Walls, M.A. (The University, and Broad Plain Soap Works, Bristol).—The first part of the report deals with the actual works practice of soap-boiling. The second part treats of the theory of soap boiling, under the headings: Historical, general review, hydration of the fibres in soap curd. The third part of the report is entitled "Application of the Theory," and deals with saponification, graining and washing, fitting and settling, and the colour and hardness of soaps.

The Concentration of Minerals by Flotation. By Edwin Edser, A.R.C.Sc., F.Ph.S., F.Inst.P. (Minerals Separation, Ltd., London)—The fundamental scientific principles underlying the flotation of minerals are treated in detail—*e.g.*, surface tension, contact angles, air films, the surfaces of liquids and solids, flocculation and deflocculation, frothing or foaming. The practice of flotation is described and an account given of the various hypotheses advanced to explain flotation. This is an extensive paper on a difficult but exceedingly important subject.

Colloids in Catalytic Hydrogenation. By E. F. Armstrong, D.Sc., F.R.S., and T. P. Hilditch, D.Sc.—Colloid phenomena obtain in the hydrogenation of gaseous or liquid organic compounds: (1) because of the surface at which interaction occurs; (2) when catalysts in the colloidal condition are employed. Catalysts may be colloidal sols or finely divided metals, non-supported or supported. The various physical and chemical conditions involved are considered, as well as the various theories of catalysis.

The Rôle of Colloids in Electrolytic Metal-Deposition. By Henry J. S. Sand, Ph.D., D.Sc., F.I.C. (Sir John Cass Technical Institute, London).—The influence of colloids in electrolytic plating solutions on the metal deposits obtained has been discussed under the headings: Phenomena produced by addition-agents; inclusion of the addition-agent in the metal-deposit, and its colloidal nature; adsorption and gold number of colloids in relation to their effectiveness as addition-agents; microstructure of deposits containing colloids; equilibrium potential of deposits containing colloids (transfer-resistance and polarisation); over-voltage produced by colloids in its relation to improved throwing-power of electrolytic baths, and

to the sequence of electrolytic processes taking place at the electrodes; nature of process by which the final structure of electrolytic metal deposits is brought about; colloids at the anode; colloids in applied metal deposition.

Rubber. By Henry P. Stevens, M.A., Ph.D., F.I.C.—In the first report (1917) Dr. Stevens gave a summary of the chief papers on rubber. This bibliography is now extended and brought up to date, and the properties of rubber are dicussed from the colloidal view-point. Vulcanisation is treated in detail.

Colloidal Fuels: their Preparation and Properties. By A. E. Dunstan, D.Sc., F.I.C. (Chief Chemist, Anglo-Persian Oil Company).—This paper is a brief summary of recent work, particularly in the United States, on colloidal fuels.

Basic Slag Manufacture

Suggestions for Developing Home Production

ACCORDING to an interim report just made to the Minister of Agriculture, there is some likelihood of there being a diminution in the supplies of basic slag next season. Farmers have complained both of the price and the quality of the supplies available to them, and the interim report deals with the subject in relation to supply and quality. The report is made by a permanent Committee appointed by the Minister to consider the development and improvement of the manufacture of basic slag and the extension of its use, and it contains a record of their experiments and deliberations during last year.

The Committee state that the demand for ground basic slag by the farmers of the United Kingdom has increased nearly twofold since 1912, and in the view of competent agricultural experts it ought still further to increase. On the other hand, the production of unground basic slag has not correspondingly increased, and in 1920 and 1921 was substantially less than the farmers' demands. Moreover, there has been a reduction in quality in consequence of the supersession of the Bessemer process by the open hearth process. The slag now obtainable (the report states), contains, on an average, only half the percentage of phosphate of pre-war days, and much of it shows reduced solubility according to the official tests.

Continuing, the report states that the demands of the farmer have been met to some extent by importation from abroad. In view of the likelihood that the quality of basic slag manufactured on the Continent may decrease, as it has in the United Kingdom, following upon a similar change in process of manufacture, and further that the demands of farmers abroad may increase, the Committee consider it would be unwise for farmers in this country to rely to any serious extent on importation.

With regard to the possibilities of increased or improved production, the Committee state that, after careful investigation, they are being reluctantly forced to the conclusion that little, if any, change in blast-furnace or steel-furnace procedure is likely to be made with the purpose of improving either the output or the quality of slag. "We are compelled to recognise that, from the steel makers' point of view, basic slag is relatively unimportant." The practical result is that the composition of basic slag is determined by the conditions under which the steel maker is working, and the total amount producible is regulated by the demand for steel.

The Committee are investigating the possibility of increasing the effectiveness of basic slag, and the possibility of finding effective substitutes in ground mineral phosphates. In the latter connection, they say the preliminary survey shows that the use of such substitutes would afford a ready means of solving the problem. They have begun careful inquiry into the fertilising value of these phosphates. So far as present information goes, it is proved that high soluble open-hearth basic slags have the same agricultural value per unit of phosphoric acid as the old Bessemer slags; that low soluble slags and mineral phosphates have a smaller value, but in some circumstances not markedly great. The Committee express the hope that they may ultimately be able to map out the country into regions where the high soluble slag can, and where it cannot, effectively be replaced by low soluble slags and mineral phosphates. They also hope to ascertain whether very low grade slag could with advantage be used with an admixture of mineral phosphates. The report concludes with the suggestion that the official solubility test needs revision.

German Aluminium Industry in July

THE *Deutsche Bergwerks Zeitung* states that according to the Federal Union of the German Aluminium Industry the position of the industry during July was satisfactory, but the prospects for the future are exceedingly doubtful. Owing to the continued depreciation of purchasing power in Germany orders are more and more for export trade, and export orders now amount to about 75 per cent. of the total orders received. In spite of the catastrophic depreciation of the mark, however, there is a falling off in orders from abroad, and there is a feeling that, in view of the political conditions brought about by this depreciation of the mark, new orders may not be received. Some works are reckoning with a partial lack of work on account of the cutting off of the English and American markets. In consequence of the uncertain conditions the future economic outlook is quite impossible to predict. Competition abroad and the strengthening of the foreign aluminium industries are factors which are making themselves increasingly felt, and, in particular, America, England, and Spain are seeking to exclude German products by high duties and anti-dumping measures. In Scandinavia the sale of German products is threatened by increasing northern competition and price undercutting. Inland prices followed but slowly the greatly increased costs of production. With a continually depreciating mark the position is made very difficult, in that payment for goods is received only some six weeks after delivery, and is at that time worth much less than when the goods were originally sold. Export prices are, according to the price regulations of the Price Examination Office, 15 per cent. above inland prices. The month under review brought increases of wages and salaries of 25–30 per cent. The wage increases with retrospective effect are particularly unpleasant, as these cannot be foreseen at the time of sale.

Work of Public Analysts in 1921

A REPORT on the work of Public Analysts under the Sale of Food and Drugs Acts, which has been published by the Ministry of Health, states that there are now 232 analysts under the Act of 1875, and that the total number of samples purchased for analysis in 1921 was 113,664, of which 7,582, or 6·7 per cent., were reported as not being genuine or up to standard. In 1920 the number taken was 111,707, of which 7,903, or 7·1 per cent., were reported against. During the past year 61,439 samples of milk were analysed, of which 5,290 were reported as adulterated, or not up to the standard. This represents a proportion of 8·6 per cent., against 9·3 per cent. in 1920. In London the proportion of adulterated milk samples was 5·1 per cent., as compared with 6·7 per cent. in 1920 and 7·7 per cent. in 1919. In the 40 largest provincial towns in England and Wales, the proportion was 9·6 per cent., and in the remainder of the country, excluding London, the proportion was also 9·6 per cent. Of the total number examined in the whole country, 114 contained a colouring matter, which consisted in most cases of annatto. Cases of adulteration of flour are reported to have been again few, and out of 947 samples of sugar only three were condemned. Out of 168 samples of preserved peas, however, 73 were condemned on account of containing copper salts for colouring purposes. Of 5,589 samples of drugs examined, 374, or 6·7 per cent., were reported against as not being genuine.

Proposed Presentation to Birmingham Chemist

MR. F. R. O'SHAUGHNESSY, consulting chemist, has resigned from the honorary secretaryship of the Birmingham and Midland Section of the Society of Chemical Industry, a position which he had held for 17 years. He not only revived the Birmingham and Midland section, making it a powerful and representative body, but was also responsible for the organisation and arrangement of two annual general meetings held at Birmingham. It is proposed that his long and loyal services should receive formal recognition from all interested in Pure and Applied chemistry in the Midlands and it is the intention to present Mr. O'Shaughnessy with a testimonial at the opening meeting of next session of the Birmingham and Midlands section. Dr. E. B. Maxted (chairman), Dr. H. W. Brownsdon, and Mr. H. Silvester (former chairman) and Mr. G. King, who succeeds Mr. O'Shaughnessy as hon. sec., are the members of the Testimonial Committee.

Safeguarding of Industries Act

Report of Glass Bottles Committee

THE report of the committee appointed by the Board of Trade to inquire into a complaint in respect of glass bottles under Part II of the Safeguarding of Industries Act has now been issued by H.M. Stationery Office [price 2d.]. It will be remembered that the complaints made by the Association of Glass Bottle Manufacturers of Great Britain and Ireland were to the effect that glass bottles manufactured in Holland are being sold or offered for sale in the United Kingdom at prices below the cost of production, and that glass bottles manufactured in Germany are being sold or offered for sale in the United Kingdom at prices below those at which similar goods can profitably be made in the United Kingdom, and that employment in this country is thereby seriously affected.

For the purpose of the inquiry the complainants defined glass bottles as including " all containers of five inches or less in internal diameter of the opening of the mouth." In the course of the inquiry it became apparent that glass bottles as so defined included articles some of which were widely different from others not only in size, shape and material, but also in the conditions of their manufacture and in the qualities that users of them required that they should possess. But in laying their case before the committee the complainants did not draw any distinction between one class or type of glass bottle and another, but contended that in respect of glass bottles generally (as above defined) their complaints were well founded and that the conditions specified in Section 2 sub-section (1) of the Safeguarding of Industries Act, 1921, were fulfilled.

The committee held seven public meetings. They examined witnesses and heard counsel, who appeared on behalf of certain witnesses, both in support of and in opposition to the complaints. In addition to general evidence given publicly with regard to the prices at which glass bottles can be profitably manufactured in the United Kingdom, the complainant Association submitted to the committee confidentially accounts and costings statements showing the cost of manufacturing various types of glass bottles by certain companies and firms who are members of the Association. In examining these, the committee had the assistance of the Finance Department of the Board of Trade. They also considered the available statistical evidence with regard to imports of glass bottles from Holland and Germany; the depreciation of the mark; and the state of employment in various industries.

The complaints were supported by the following bodies of manufacturers and workers engaged in the glass bottle manufacturing industry:—The Association of Glass Bottle Manufacturers of Great Britain and Ireland; the English and Scottish Glass Bottle Manufacturers' Association; the London Glass Bottle Manufacturers' Association; the Yorkshire Flint Glass Bottle Manufacturers' Association; the National Federation of Glass Bottle Workers of Great Britain and Ireland; the London Glass Blowers' Trade Society; and the National Joint Industrial Council for the Glass Manufacturing Industry (Bottles and Jars Sectional Council). The complaints were opposed by the Food Manufacturers' Federation, by the China and Glassware Section, the Owners of Proprietary Articles Section, the Infant and Invalid Food Manufacturers' Section, and the Perfumery Manufacturers' Section of the London Chamber of Commerce, and by a number of companies, firms and individuals engaged in various industries.

The Committee's Findings

In conclusion, the committee state that they have carefully considered the evidence with regard to the prices at which glass bottles can be profitably manufactured in the United Kingdom and the comparison between such prices and the prices at which it was alleged that similar glass bottles manufactured in Germany are being offered for sale in the United Kingdom. They have taken into account the statistics as to the importation of glass bottles from Germany. To a considerable—but they have not the means of estimating to what—extent such importation is due to an actual or traditional superiority of the German article; but to a large extent it is due, no doubt, to German glass bottles being offered for sale at prices below the prices at which similar bottles manufactured in the United Kingdom are offered for sale, and in some cases below the prices at which similar glass bottles can be profitably manufactured in the United Kingdom. But the evidence falls very far short of establishing that, speaking generally, glass bottles manufactured in Germany are being sold or offered for sale in the United Kingdom at prices below the prices at which similar glass bottles can be profitably manufactured here. On the contrary, the committee are of opinion that, though there may be exceptions, glass bottles generally can be profitably manufactured in the United Kingdom at prices that would compete with the prices at which glass bottles manufactured in Germany are being sold or offered for sale in the United Kingdom. On this ground they report unanimously that as respects glass bottles manufactured in Germany the conditions specified in Section 2 sub-section (1) of the Safeguarding of Industries Act, 1921, are not fulfilled.

Institute of Metals

New Series of Annual Lectures

A NOTABLE feature of the forthcoming Swansea meeting of the Institute of Metals will be the inauguration of a series of annual public lectures on " Subjects of Practical Interest to those Engaged in the Non-Ferrous Metals Industry." The lectures are additional to the well-known annual May lectures of the Institute of Metals, which have constituted a notable feature of the Institute's work since 1910. Dr. R. S. Hutton, a member of council of the Institute and director of the British Non-Ferrous Metals Research Association, is to deliver the first of the new lectures, this being entitled " The Science of Human Effort (Motion Study and Vocational Training)." The lecture will be given at 8 p.m. on Tuesday, September 19, at the Y.M.C.A., Swansea.

Tickets can be obtained from Mr. G. Shaw, Scott, 36, Victoria Street, London, S.W.1, who will be glad to send particulars of membership of the Institute to persons desirous of taking part in the subsequent proceedings at Swansea. These include the discussion of 15 papers on various metallurgical subjects, civic and other receptions and entertainments, visits to works, and a motor tour round the Gower Peninsula, the entire meeting lasting from Tuesday, September 19, to Friday, September 22.

Brass Casting Research

THE British Non-Ferrous Metals Research Association, 71, Temple Row, Birmingham, has carried out an extensive research on the influence of gases on high-grade brass. A further investigation has been undertaken by the Association at the Research Department, Woolwich, in which the support of the Engineering Co-ordinating Board of the Department of Scientific and Industrial Research has been secured. The advance which has been made in the quality of materials as a result of the increasing demands of the engineer is not always easy to appreciate even by those most closely connected with the industry. Well defined specifications and the provision of a greater variety of tests have certainly assisted in these improvements. Brass, both in its cast and worked forms, has shared in full measure in this progress, but the demand is ever for further improvements. The primary object of the present work is to study the conditions necessary for securing both surface and internal soundness of strip brass ingots such as are required for cold rolled sheet metal. The investigation should throw light on other types of casting in non-ferrous alloys and should interest a wide circle of manufacturers in the metal and engineering trades. Dr. Harold Moore and Mr. B. Genders, who have already been engaged successfully on similar work, will have charge of the research, which will be conducted partly in the works of members of the Association and partly in the Woolwich laboratories.

Greek Olive Oil Production

THE total production of olive oil for 1921 is estimated by the Commercial Secretary to H.M. Legation at Athens at 45,180,000 kilogs. The crop in Crete is reported as 6,500,000 kilogs., as compared with 39,500,000 kilogs. in 1920. The crop at Zante is estimated at about 400,000 gallons, most of which will be consumed locally, partly as edible oil and partly for soap manufacture. In 1921, 2,280 tons of olive oil soap were exported to Greek and Levant markets, as against 1,875 tons in 1920.

Fatality at Chemical Works

THE Manchester City Coroner, assisted by H.M. Inspector of Factories, conducted an inquiry on Monday into the death of Harry Earle, aged 19, of Lostock, Gralam. Mr. John Earle said his son was employed at the chemical works of Brunner, Mond and Co., Ltd., and following an accident was brought home on June 17, when he said that he had fallen from a platform through walking on a rotten plank which had given way. Ernest Yarwood, the foreman, explained that the platform from which the deceased fell was a permanent structure and was in process of being demolished at the time of the accident. It was about 12 feet from the ground and rested on trestles and was intended for the conveyance of pipes running through the works. The deceased had been told to stand on a trough which ran alongside, and it appeared that instead of coming down and moving the ladder to another spot he had chosen to walk along with one foot on the plank, which gave way. Four days after the accident Earle was removed to the Victoria Hospital, and some time later was transferred to the Royal Infirmary at Manchester where he died from septic infection. The Coroner, returning a verdict of accidental death, said there was always a certain danger attending any demolition work. It was not a case where the structure in question was provided for a man to stand on. Had that been so and it had given way it would have been a serious matter.

Affairs of a Chemical Manufacturer

THE public examination of Alfred Prescott, chemical and aniline dye manufacturer and manufacturing chemist, carrying on business at Rutland Mills, Oswald Street, Hulme, Manchester; Drake Street, Holt Town, Manchester; and the Mill Bank Chemical Works, Halifax, took place at the Manchester Bankruptcy Court on August 25. The debtor's statement of affairs showed gross liabilities amounting to £39,292, with assets estimated to produce £7,101, thus leaving a deficit of £32,191. The debtor attributed his failure to bad debts, losses on shipments not taken up by customers, to shrinkage in export trade through the disorganisation of the foreign exchanges, to depreciation in the value of stocks, and to customers not completing contracts. Questioned by the Official Receiver, he stated that up till 1918 he had made a steady and continuous profit, his best year being 1916, when his profit amounted to £16,000. The first losses were made in 1919, and after then the business grew worse and worse. Further questioned, the debtor stated that he had never drawn more than £1,000 a year from the business for his personal use. The examination was closed.

Oil Merchant's Failure

THE first meeting of the creditors of Charles Lister and William Lister, trading as C. and W. Lister, the Market Place, Uttoxeter, and French Chambers, Queen's Dock Side, Hull, Yorkshire, oil merchants, was held recently at the Official Receiver's Office, 4, Castle Place, Nottingham. The statement of affairs showed liabilities of £262, and there was a deficiency of £188. The debtors attributed their failure to insufficient capital, heavy travelling expenses and illness. It appeared that they commenced business at Hull in January, 1921. There was not a quorum of creditors present at the meeting, and the matter was left in the hands of the Official Receiver as trustee of the estate.

Duty on Oxalic Acid

THE Board of Trade have received a formal notice of complaint under section 1, sub-section 5, of the Safeguarding of Industries Act that "Oxalic Acid" has been improperly included in lists of articles chargeable with duty under Part I of the Act. The complaint will be submitted in due course to the Referee appointed by the Lord Chancellor for the purposes of the sub-section and any person directly interested should communicate immediately with the Assistant Secretary, Board of Trade (Industries and Manufactures Department), Great George Street, London, S.W.1.

Canadian Substitute for Pine Oil

Use in Ore Concentration by Flotation

A PAMPHLET on the natural resources of Canada, issued by the Department of the Interior, Ottawa, describes in some detail the work of the Forest Products Laboratories, which are conducted under the Forestry Branch of the Department and are affiliated with McGill University. The staff now consists of forty persons, of whom nearly half are technical men. In addition to the useful results obtained from investigations of all Canadian commercial woods, one of the most striking successes of the Laboratories was the discovery of a substitute for pine-tar oil, used in the oil flotation process of refining ore. This process is extensively used in Canada.

As originally developed, the process could only be worked by the use of pine oil, a product of the pines of the Southern States. Owing to the enormous demand for pine oil which the discovery of this process created, the price rose to ten and fifteen times its original figure, and frequently for months at a time Canadian reduction plants were unable to get it at any price. In this extremity a number of Canadian mine owners appealed to the Minister of the Interior, and the Minister directed the Laboratories to investigate the question. The investigators succeeded in making pine oil from Canadian red pine stumps, but at a cost too high to render its use commercially feasible. They went further, however, and after eight months' work succeeded in utilising a waste product of the wood distillation industry. This waste product, slightly refined, was found to do the work in the reduction plants just as well as the original article. In this investigation the Forest Products Laboratories had the co-operation of the Department of Mines, the experts of which tested in practical ore reduction the different oils produced, until a satisfactory one was obtained. Canadian mining companies expressed their great appreciation of the work of the investigators.

Importation of Oleo-Stearine

AT the monthly meeting of the Manchester Port Sanitary Authority on Monday it was reported that during the month 31 3-cwt. barrels of inedible oleo-stearine were re-exported to Holland under the Foreign Meat Regulations. The consignment had been imported for the express purpose of being used as an ingredient in the manufacture of dripping, the declared value of the material being £280. The Medical Officer also reported that on July 24, 200 tierces of "inedible white grease" were landed and were detained. As this was consigned to a firm previously reported as utilising the product for the manufacture of refined lard, a notice was served for re-exportation under the Foreign Meat Regulations. The re-exportation was, however, not enforced on the owner giving an undertaking that the whole of the material would be sold for the purpose of soap-making. The declared value of this consignment was £1,580. Asked what had become of the consignment, the Medical Officer said it was now being stored and it would have to be used for soap-making.

New Soapstone Deposits in Canada

WHAT promises to be an important and valuable source of soapstone has lately been investigated by Mr. H. S. Spence, of the Canadian Department of Mines. The deposit occurs one mile west of Wabigoon, on the Canadian Pacific Railway, near Dryden, Ontario, and is only 500 yards from the railway. There is very little overburden, and the outcrops indicate a large body of soapstone. It is stated that the stone may be termed soapstone, though, beyond being soft enough to cut readily with an ordinary saw, it bears little resemblance to what is usually classed as soapstone. It is a dark, greenish-grey rock, composed largely of talc, and is very similar in appearance and in composition to the so-called "alberene stone" of Virginia, which is extensively used for switchboard panels, laboratory equipment, and laundry tubs, and for lining furnaces and digesters, etc. The Wabigoon deposit is considered to be the most promising, from an economic standpoint, of any of the soapstone occurrences as yet found in Canada.

From Week to Week

BURROUGHS, WELLCOME AND CO. propose building a large suite of offices on a site in East 41st Street, New York.

FOR KEEPING 800 lb. of explosives in an unlicensed place, a Mr. J. Jones was fined £1 at Caerphilly last week.

MR. W. CUNDLIFF, of W. Baker and Co., chemical manufacturers, Manchester, is the Lord Mayor-elect of Manchester.

TABOR, TREGO AND CO., LTD., varnish manufacturers, announce the removal of their offices to 9, New Broad Street, London.

MR. H. M. GREGORY has been elected Master, and Messrs. T. W. Allt and C. E. Hartley, Wardens, of the Wax Chandlers Company.

QUANTITIES of gelignite, aluminium powder, barium nitrate, and fulminate of mercury were seized in Dublin last week by Free State troops.

THE SOUTH YORKSHIRE GLASSMAKERS are reported to be doing very badly in the bottle departments owing to restricted demand.

THREE FIREMEN were overcome by sulphuric acid fumes at a fire at the premises of a firm of motor engineers in Vauxhall Bridge Road on Monday.

THE CITY AND GUILDS OF LONDON INSTITUTE is removing the offices of the Department of Technology to 29, Roland Gardens, Old Brompton Road, South Kensington, London.

MR. CALEB MARGERISON, of the firm of Joshua Margerison and Co., soap manufacturers, Leighton Street, Preston, has died at "Crogga," near Port Soderick, Isle of Man, at the age of 61.

PROVISION IS MADE in a new Chilean Government Bill for granting facilities to producers of saltpetre to accumulate stocks in centres where they are required with a view to assisting export trade.

THE DUTCH GOVERNMENT is reported to have informed the International Union of Rubber Cultivation in the Netherlands Indies that it is unwilling to take action in regard to the restriction of rubber output.

BARRELS OF INFLAMMABLE LIQUID at the premises of Taylor's Automatic Disinfectors, Ltd., Liverpool, were found to be on fire on Monday afternoon. The outbreak was extinguished before very serious damage had been done.

THE DEATH is announced, after a short illness, of Mr. R. H. Wilson, chairman of the Egglescliffe Chemical Co., Ltd., Yarm. Mr. Wilson was also a director of Sadler and Co., Ltd., chemical manufacturers, Middlesbrough.

ONE GRAMME OF RADIUM has been purchased by the Province of Quebec from the United States Radium Corporation, at a cost equivalent to about £22,000. The radium was mined in Colorado and extracted at Orange, New Jersey.

DECREASES IN WAGES of 2s. 6d. per week for men, 1s. 6d. for women, and varying amounts for juvenile workers have become operative in regard to workers in the paint, colour, and varnish industry in Birmingham and district.

PHOSPHATE AND NITRATE DEPOSITS in the State of Nueva Leon will probably be developed in the near future, the Minister of Industry having, according to an Agencia Americana message from Mexico, sanctioned their exploitation.

A LECTURER IN PHYSICS is required by next March at the University of Capetown. Particulars of salary and conditions of the appointment may be obtained from the secretary, Office of the High Commissioner for the Union of South Africa, Trafalgar Square, London.

AT THE SITTING on August 26 of the International Law Association, which is holding a Conference at Buenos Aires, a British delegate moved a resolution in favour of prohibiting the manufacture and use of asphyxiating gas. The resolution was passed, Herr Simons, the German delegate, voting for it.

A PROCESS for changing the natural colour of a growing tree at will is reported to have been discovered by a German scientist. This process, which consists in injecting aniline dyes into the tree, is by no means new, but a revival of this practice would seem to open out prospects of a further demand for dyestuffs.

MR. WILLIAM IVEY, chairman of Oilfields of England, Ltd., has been compelled, owing to family illness, coupled with increased pressure of other business, to resign from the chairmanship of the company. The resignation will not, however, involve the termination of Mr. Ivey's interest in the company, as he has consented to act in a consultative capacity.

THE SECRETARY of the Department of Scientific and Industrial Research announces that Engineer Vice-Admiral Sir George Goodwin and Dr. James Colquhoun Irvine, C.B.E., F.R.S., Vice-Chancellor and Principal of St. Andrews University, have been appointed by an Order of Council, dated August 10, 1922, to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

IN CONNECTION WITH the International Conference on Liquid Fuels referred to in THE CHEMICAL AGE last week, an International Exhibition of Liquid Fuels will be held in Paris from October 4 to 15. Applications for space should be addressed to M. J. Gerard, Commissaire Général, 49, Rue des Mathurins, Paris. Copies of the regulations and forms of application for space can be obtained from the Department of Overseas Trade (Exhibitions and Fairs Division), 35, Old Queen Street, London, S.W.1.

IN A LETTER to the Press Captain E. A. Bagley, M.P., reminds the public that the making of dyestuffs in this country is not a novel performance. He traces the history of the industry from the days of Perkin, and states that the British Dyestuffs Corporation, Ltd., now employs 300 trained chemists and 6,000 workpeople, operating on 50 acres of floor area amidst 1,450 acres more of land. With so splendid an evolution since Perkin discovered mauve in 1856, Captain Bagley asks who will put a limit to its development in the years to come?

THE AMERICAN COMMERCIAL ATTACHÉ at Santiago, in reporting by cable that July exports of nitrate from Chile were in excess of those effected during June, says that it is expected that the continued sales of nitrate for August delivery will bring increasing strength to the economic position. Purchasing by the consumers throughout Chile is reported to be on the increase; but despite this, merchants continue their policy of placing orders in moderate quantities. The increased employment in the copper mining districts and the gradual resumption of nitrate production have resulted in a much better labour situation.

THE COMMERCIAL SECRETARY at Copenhagen has forwarded to the Department of Overseas Trade a report dealing with the output of Danish glassworks. This report states that the Danish glass industry has for several years had to contend with serious difficulties. During the greater part of 1917, and at various times during the other years of the war, the production had to be greatly limited owing to the lack of raw materials and fuel. In 1919 the production was again brought up to its former level, but competition from abroad then began to make itself felt, which, in conjunction with the decreased sales, necessitated a further limitation in the output, so that during 1921 the production was far below the normal.

MR. F. E. HAMER (Editor of THE CHEMICAL AGE) leaves from Southampton by the "Majestic" on September 27 for New York, to attend an important three-days conference of American Publishing Houses on October 11, 12, and 13, at the invitation of the Associated Business Papers, Inc., of New York (the international organisation of trade, technical and class publications). He will attend the conference as a delegate from the Weekly Newspaper Proprietors' Association, London, and as the personal representative of the firm of Benn Brothers, Ltd. By the invitation of official bodies, Mr. Hamer will visit Washington and probably various centres in Canada, and he has arranged to see the heads of a number of chemical and dyestuff companies.

MR. H. C. HOOPS, of Sinclair, Valentine and Hoops, Ltd., Toronto, and Mr. F. A. Ridgway, manager of the chemical department of that company, have returned to Canada from a six-weeks business trip to the United Kingdom. During their stay in this country, they secured the Canadian and American agencies for several English chemical manufacturing firms. Among the agencies they secured were: Boks and Co., Ltd., London; British Zinc Products, Ltd., Swansea; H. L. Morgan Co., Ltd., St. Austell; L. Taylor and Co., Ltd., London; and F. Jones and Co., Ltd., Swansea. Mr. Hoops and Mr. Ridgway were both impressed with the enthusiastic determination of British chemical manufacturers to win their way through out of the present period of readjustment. In their opinion the export business of the United Kingdom shows particular advancement.

References to Current Literature

British

THEORIES.—Radiation and chemistry. J. Perrin. *Trans. Faraday Soc.*, May, 1922, pp. 546–572.

The radiation hypothesis of chemical reactivity and some of its applications. W. C. McC. Lewis. *Trans. Faraday Soc.*, May, 1922, pp. 573–587.

A theory of chemical reaction and reactivity. E. C. C. Baly. *Trans. Faraday Soc.*, May, 1922, pp. 588–595.

REACTIONS.—Chemical reactions on surfaces. I. Langmuir. *Trans. Faraday Soc.*, May, 1922, pp. 607–620.

COMBUSTION.—Limits for the propagation of flame in vapour-air mixtures. Part I. Mixtures of air and one vapour at the ordinary temperature and pressure. A. G. White. *Chem. Soc. Trans.*, July, 1922, pp. 1244–1270.

HETEROCYCLIC COMPOUNDS.—The influence of substituents on the formation and stability of heterocyclic compounds. Part I. Hydantoins. C. K. Ingold, S. Sako and J. F. Thorpe. *Chem. Soc. Trans.*, July, 1922, pp. 1177–1198.

ORGANIC SALTS.—The hydroferrocyanides and hydroferricyanides of the organic bases. Part I. W. M. Cumming. *Chem. Soc. Trans.*, July, 1922, pp. 1287–1298.

MOLECULES.—On the structure of some gaseous molecules of which hydrogen is a constituent. A. O. Rankine. *Trans Faraday Soc.*, May, 1922, pp. 719–727.

The energy of gaseous molecules. J. R. Partington. *Trans Faraday Soc.*, May, 1922, pp. 734–741.

SUGARS.—2 : 3 : 6- Trimethyl glucose. J. C. Irvine and E. L. Hirst. *Chem. Soc. Trans.*, July, 1922, pp. 1213–1223.

The constitution and rotatory powers of mannitol and fructose complexes formed in solutions containing boric acid and sodium hydroxide. G. V. B. Gilmour. *Chem. Soc. Trans.*, July, 1922, pp. 1333–1340.

ANALYSIS.—Studies in the titration of acids and bases. J. L. Lizius and N. Evers. *Analyst*, August, 1922, pp. 331–341.

The sulphuric acid reaction for liver oils. J. C. Drummond and A. F. Watson. *Analyst*, August, 1922, pp. 341–349.

PHYSICAL CHEMISTRY.—A new physico-chemical law. H. Collins. *Chem. News*, Part I., August 18, 1922, pp. 81–83; Part II., August 25, 1922, pp. 97–98.

British Dominions

PIGMENTS.—The manufacture of black pigments. Part II. H. L. Blachford. *Canad. Chem. and Met.*, August, 1922, pp. 180–182.

WOOD.—The effect of chemicals on the ignition temperature of wood. W. O. Banfield and W. S. Peck. *Canad. Chem. and Met.*, August, 1922, pp. 172–176.

NATURAL GAS.—The absorption of gasoline from natural gas. Part I. R. C. Cantelo. *Canad. Chem. and Met.*, August, 1922, pp. 177–179.

ANALYSIS.—Notes on the detection and estimation of small amounts of platinum and palladium in the presence of large amounts of silver. C. A. Knittel. *Canad. Chem. and Met.*, August, 1922, pp. 179–180.

United States

LUBRICATION.—The mechanism of lubrication. Part I. General. Part II., Methods of measuring the property of oiliness. R. E. Wilson and D. P. Barnard. *J. Ind. Eng. Chem.*, August, 1922, pp. 682–695.

QUINOLINES.—Preparation of α, γ-quinolines. Part I., 2.4-Dimethyl-6-ethoxyquinoline : an improved method for its preparation. S. Palkin and M. Harris. *J. Ind. Eng. Chem.*, August, 1922, pp. 704–705.

ELECTRO-CHEMISTRY.—The technology of the carbon electrode industry. Part IV. Grinding, mixing, moulding and extrusion. C. L. Mantell. *Chem. and Met. Eng.*, August 9, 1922, pp. 258–264.

CEMENT.—Quality control in cement manufacture. R. K. Meade. *Chem. and Met. Eng.*, August 9, 1922, pp. 250–253.

OXIDATION.—Sulphur compounds and oxidation of petroleum oils. C. E. Waters. *J. Ind. Eng. Chem.*, August, 1922, pp. 725–727.

CARBOHYDRATES.—Moisture absorptive power of different sugars and carbohydrates under varying conditions of atmospheric humidity. C. A. Browne. *J. Ind. Eng. Chem.*, August, 1922, pp. 712–714.

TECHNOLOGY.—The utilisation of waste heat. *Chem. and Met. Eng.*, August 9, 1922, pp. 267–271.

CATALYSIS.—The catalytic formation of water vapour from hydrogen and oxygen in the presence of copper and copper oxide. R. N. Pease and H. S. Taylor. *J. Amer. Chem. Soc.*, August, 1922, pp. 1637–1647.

SELENIUM.—Some properties of selenium oxychloride. Part II. V. Lenher. *J. Amer. Chem. Soc.*, August, 1922, pp. 1664–1667.

Selenium oxybromide. V. Lenher. *J. Amer. Chem. Soc.*, August, 1922, pp. 1668–1673.

ZIRCONIUM.—Zirconium ferrocyanide and ferricyanide. F. P. Venable and E. O. Moehlmann. *J. Amer. Chem. Soc.*, August, 1922, pp. 1705–1707.

Zirconyl citrate. F. P. Venable and R. A. Lineberry. *J. Amer. Chem. Soc.*, August, 1922, pp. 1708–1709.

ORGANIC MERCURY COMPOUNDS.—The structure of the compounds produced from olefines and mercury salts : mercurated dihydrobenzofurans. R. Adams, F. L. Roman and W. N. Sperry. *J. Amer. Chem. Soc.*, August, 1922, pp. 1781–1792.

DIAZO COMPOUNDS.—Optically active diazo compounds. Part II. H. M. Chiles and W. A. Noyes. *J. Amer. Chem. Soc.*, August, 1922, pp. 1798–1810.

German

ELECTRO-CHEMISTRY.—The electrolytic separation of copper-tin alloys. P. Weise. *Z. Elektrochem.*, August, 1922, pp. 327–341.

The state of dissociation of moderately strong acids, particularly dichloracetic acid, in water and salt solutions. E. Schreiner. *Z. anorg. u. allg. Chem.*, July 12, 1922, pp. 201–235.

RARE EARTHS.—The separation of rare earth metals by basic precipitation. Part IV. W. Prandl and J. Rauchenberger. *Z. anorg. u. allg. Chem.*, July 12, 1922, pp. 311–314.

GERMANIUM.—Germanium. Part III. Germanium tetrabromide and tetrachloride. L. M. Dennis and F. E. Hance. *Z. anorg. u. allg. Chem.*, July 12, 1922, pp. 265–276.

The identification of germanium by its visible arc-spectrum. J. Papish. *Z. anorg. u. allg. Chem.*, July 12, 1922, pp. 262–264.

TUNGSTEN.—A new microchemical method for the detection of tungsten. J. A. M. van Liempt. *Z. anorg. u. allg. Chem.*, July 12, 1922, pp. 236–238.

ZINC.—The separation of zinc from other metals, especially nickel. A. Ludwig. *Z. anorg. u. allg Chem.*, July 12, 1922, pp. 239–261.

ANALYSIS.—Comparison of the methods for the estimation of nitric oxide. A. Klemenc and C. Bunzl. *Z. anorg. u. allg. Chem.*, July 12, 1922, pp. 315–331.

A new iodometric method which depends upon the formation and estimation of cyanogen iodide. Part I. R. Lang. *Z. anorg. u. allg. Chem.*, July 12, 1922, pp. 332–348.

The estimation of sulphuric acid as barium sulphate in the presence of aluminium. L. Moser and P. Kohn. *Z. anorg. u. allg. Chem.*, July 12, 1922, pp. 299–310.

FATS.—The present position of fat hardening. W. Normann. *Z. angew. Chem.*, August 8, 1922, pp. 437–440.

GRAPHITE.—Investigations of artificial and natural graphite. K. Arndt and F. Körner. *Z. angew. Chem.*, August 8, 1922, pp. 440–443.

COLLOIDS.—The scope of colloid chemistry. The study of structure. R. Zsigmondy. *Z. angew. Chem.*, August 15, 1922, pp. 449–451.

FERTILISERS.—The advantages of the use and production of ammonium bicarbonate for fertiliser purposes. W. Gluud. *Chem.-Zeit.*, August 3, 1922, pp. 693–697.

Patent Literature

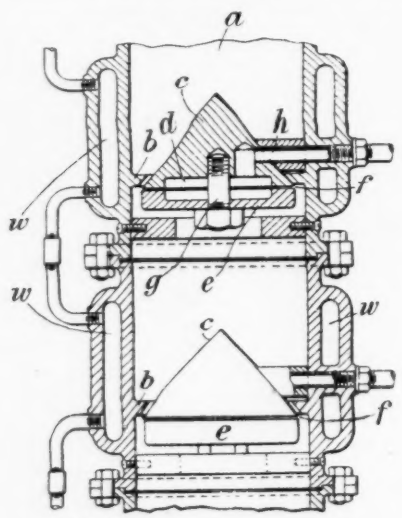
Abstracts of Complete Specifications

183,507. TIN, TREATMENT OF. A. E. White, London. From American Smelting and Refining Co., 120, Broadway, New York. Application date, February 24, 1921.

The process is for refining tin by electrolytic deposition, using anodes of impure tin. This process has been used with an electrolyte containing 6 per cent. of tin, 0·1 per cent. sulphuric acid, and 20 per cent. of hydrofluosilicic acid, but it is sometimes difficult to maintain the percentage of tin as high as 6 per cent. with some grades of tin. Further, the hydrofluosilicic acid required is expensive. It is now found that the proportion of hydrofluosilicic acid may be reduced by adding also some form of cresylic acid, preferably the crude residue remaining in the still after the cresylic acid has been distilled off. Other substances, such as a mixture of *m*-cresol, *o*-cresol and *p*-cresol, or benzol, may be used. A deposit of pure tin is obtained even when the electrolyte contains only 2 per cent. of tin. In an example, the electrolyte consists of cresylic acid 0·3 per cent., hydrofluosilicic acid 5·5 per cent. and sulphuric acid 5 per cent. A current is passed through this solution until it takes up about 2 per cent of tin. When this solution is electrolysed with tin anodes, a hard crystalline deposit of tin 99·9 per cent. pure is obtained. This process is applicable to the refining of highly impure grades of Bolivian and other South American ores. It is also found that even better results are obtained by the addition of a small quantity of glue with the cresol.

183,527. DESULPHURISING OILS, MEANS FOR. A. C. Nesfield, 16, Madeley Road, Ealing, London, W. Application dates, March 24 and June 14, 1921.

The apparatus is for desulphurising oils and subjecting them to the action of chlorine, with or without lime. A reaction vessel *a* contains an annular baffle *b* and a concentric conical deflector *c*. A recess *d* at the base of the cone is covered by a disc *e*, which may be adjusted by a bolt *g* to vary the width



183,527

of the peripheral slot *f* between the two parts. Each deflector is supported by a gas inlet pipe *h* through which chlorine is supplied to the slot *f*. Oil is supplied from a preheater to the top of the reaction chamber *a*, through which it passes downwards over the baffles, and the film of oil is treated with chlorine from the slot *f*. The oil then passes to a settling vessel where sulphur and water settle out. In a modification, an oil reservoir may be provided above the chamber *a*, into which powdered lime is fed in regulated quantities by a worm conveyor. It is found that sulphur is more readily precipitated by chlorine in the presence of lime. The oil is then cooled and passed through a rotary vacuum filter. The chlorine leaving the chamber *a* may be passed through a pipe coil in the oil reservoir to condense any volatile products, and the chlorine may then be used again. Steam jackets *w* may be provided to heat the oil in the reaction chamber if necessary.

183,535. CHINA CLAY OR LIKE CLAYS, TREATMENT OF. T. Rigby, 72, Victoria Street, London, S.W.1. Application date, April 16, 1921.

A suspension of china clay in water is allowed to settle by gravity or is separated by mechanical means until it becomes a thick paste having a water content of about 50 per cent. The material is then dried in an evaporating plant such as that described in Specification No. 149,055 (see THE CHEMICAL AGE, Vol. III., p. 292). In the drying plant the material is fed in a parallel series of thin films on to drying surfaces arranged in a number of chambers connected to operate in multiple effect. In this apparatus the drying surfaces are heated by vapour evolved from material being dried, the vapour being compressed to raise its temperature. The process of drying the wet clay in blocks in a kiln by combustion gases is thus avoided, and the dry clay is obtained by a rapid and continuous method.

183,566. PEAT FOR FUEL OR DISTILLATION PURPOSES, METHOD AND APPARATUS FOR DISINTEGRATING, DEHYDRATING AND OTHERWISE TREATING. C. W. G. Clewlow, 108, Exchange, Cardiff. Application date, April 25, 1921.

Peat is mechanically disintegrated in a mill and then transferred to a macerating unit where 1-2 per cent. of milk of lime is added, together with water, to bring the proportion up to 90-95 per cent. The peat pulp is then forced through a pipe of enlarging section by a steam jet and is delivered at a pressure of 120-130 lb. per square inch into a cylinder heated by a steam jacket to about 300° F. The peat passes from the heater through a pressure relief valve into a closed receiver, so that the pressure is suddenly reduced and the resulting evolution of steam liberates some of the combined water which is not usually removable from the peat. A vapour discharge pipe may be provided leading from the expansion space to a vapour separating chamber, having a perforated drainage chamber at the bottom.

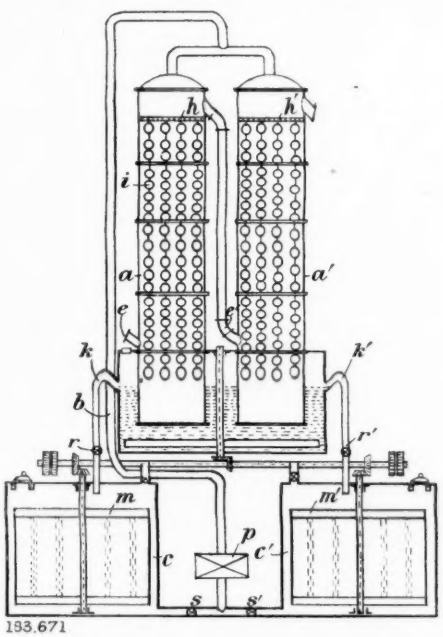
183,629. SYNTHETIC RESINS, PREPARATION OF. D. G. Anderson, 5, Booth Place, Falkirk, Stirling, and R. Maclaurin, Homesteads, Stirling. Application date, May 17, 1921.

Synthetic resins are obtained by condensing monohydroxy phenols, having a boiling point between 220° C. and 330° C. with formaldehyde in the presence of a catalyst such as ammonia, caustic soda or an acid. It is found that such phenols are present in tars obtained by the low temperature distillation of coal, and may be extracted from the crude oil distillates in the usual way. In an example, the resin is obtained from high boiling phenols 100 parts, 40 per cent. commercial formaldehyde 40 parts, and ammonia (Sp. gr. 0·880) 1-5 parts. These resins possess the property of complete solubility in benzene and its homologues when cold.

183,671. HYPOCHLORITES AND CHLORATES, PROCESS AND APPARATUS FOR THE PRODUCTION OF. M. Wilderman, 72, Fellows Road, Hampstead, London, N.W.3. Application date, June 16, 1921.

The process is for the chlorination of calcium or magnesium hydrate to produce calcium or magnesium hypochlorite and subsequently alkali chlorates. The velocity of the chlorination reaction is directly proportional to the square of the concentration of the hydroxyl ions of the calcium hydroxide in solution; to the concentration of the chlorine gas; and to the surface of contact between the gas and the solution. The concentration of the chlorine gas is usually constant, so that this factor is eliminated. The solubility of calcium hydroxide is very small (0·131 per cent. at 0° C., 0·113 per cent. at 30° C. and 0·075 per cent. at 70° C.) so that most of the calcium hydroxide is in suspension and must be kept in circulation. As the chlorination proceeds and calcium hypochlorite and chloride are formed, the solubility of calcium

hydroxide in water is very greatly diminished owing to the high dissociation of the chloride. The decrease of the hydroxyl ions in the solution causes a rapid decrease in the rate of formation of calcium hypochlorite, since this rate depends upon the square of the hydroxyl ion concentration. Similarly the conversion of the hypochlorite into chlorate is proportional to the square of concentration of the ClO ions, and it rapidly diminishes with the concentration of the hypochlorite. The object is to overcome the drawbacks of the existing processes and to obtain highly concentrated solutions of hypochlorite without the use of evaporation, and also to obtain pure potassium chlorate from these solutions. To maintain the high concentration of the liquor under chlorination, the calcium hydroxide is added gradually during chlorination to

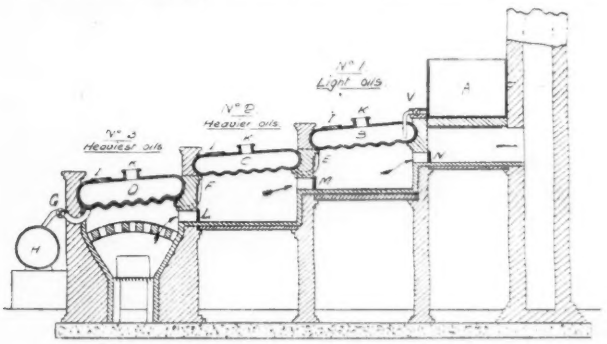


193,671

avoid the presence of a large proportion of calcium hydroxide in suspension. The temperature is not allowed to rise above 60°–70° C. during chlorination, to avoid decomposition of the chlorates. After conversion into potassium chlorate, the chlorate is crystallised out at about 15° C. and the mother liquor is then diluted until it contains only 45–50 grams of calcium chloride in 100 grams of water. Such a solution can be cooled to –20° C. without crystallisation of calcium chloride or ice, so that a more complete separation of the potassium chlorate is obtained. The absorption towers *a*, *a'* are constructed of superposed earthenware tubes and are closed at the bottom by liquid seals *b*. The milk of lime is supplied by a pump *p* to the top of each tower, where it is distributed in a finely divided condition by a perforated plate *h* near the inlet. The liquor is distributed over a large number of glazed ea thenware balls *i* supported on vertical rods, which provide a large surface, and the chlorine gas is admitted through the inlets *e*, *e'*. The milk of lime is contained in a vessel *c* and is agitated by a rotary device *m* preferably in the form of chains stretched on a frame. Outlet syphons *k*, *k'* are provided to discharge the liquor from the vessel *b* to the vessels *c*, *c'*. The operation is started by opening the valves *r*, *s*, and closing the valves *r'*, *s'*, so that milk of lime is supplied from the vessel *c* to the top of the towers. The chlorine, after passing through the first tower *a*, passes downwards to the inlet *e'* of the second tower. Fresh milk of lime is periodically added to the mixer *c*. The chlorine is diluted with 85–90 per cent. of air to prevent the temperature from rising above 60°–70° C. When conversion of the hypochlorite into chlorate is taking place, additional cooling must be provided. When the reaction is completed, the valves *r*, *s* are closed and *r'*, *s'* opened, so that the vessel *c'* is brought into use. The solution obtained is filtered while hot, and treated with an excess of about 2 per cent. of potassium chloride at 60°–70° C. The potassium chlorate is crystallised out at ordinary temperature, and the mother liquor is then cooled to –20° C. or lower to obtain a further quantity of potassium chlorate. In this process, the chlorination and transformation into potassium chlorate are effected at temperatures sufficiently low to prevent decomposition of the chlorate, and it is possible to obtain about 90–92 per cent. of potassium chlorate, which represents an efficiency about 18 per cent. higher than is obtained with the older processes. The highly concentrated hypochlorites obtained may alternatively be used for bleaching purposes in the place of bleaching powder.

183,682. STILLS FOR CONTINUOUS DISTILLATION OF COAL TAR MINERAL OILS AND THE LIKE. J. A. Yeadon, 4, Albion Place, Leeds. Application date, June 30, 1921.

The apparatus is for distilling coal-tar or mineral oils to obtain gas, oils, and other by-products. Three stills B, C, D are used for extracting the light oils, medium oils, and heavy oils respectively. Each still is of rectangular form, the bottom being formed with transverse corrugations which add to the strength of the still and secure an increased heating surface and assist in the circulation of the tar by its passage over them. Each still is slightly inclined, and they are arranged in steps



183,682

as shown with the heating furnace under the lowest still. The tar is supplied from a tank A and passes downwards through the stills in succession, while the residual pitch is discharged to the pipe H. A vapour outlet K is provided for each still. The temperature decreases from the lowest to the highest still, and the hot combustion gases are finally used for preheating the tar in the tank A.

NOTE.—Abstracts of the following specifications, which are now accepted, appeared in THE CHEMICAL AGE when they became open to inspection uuder the International Convention :—160,427 (A. Pacz), relating to production of high temperatures and reduction of refractory oxides, see Vol. IV., p. 592; 165,788 (R. Adler), relating to manufacture of decolorising charcoal of high activity, see Vol. V., p. 316; 167,157 (F. Hoffmann-la Roche and Co., Akt.-Ges.), relating to manufacture of allyl arsinic acid, see Vol. V., p. 412; 167,164 (L. Waldo), relating to reduction of magnesium compounds, see Vol. V., p. 412.

International Specifications not yet Accepted

181,674. DYES. National Aniline and Chemical Co., Inc., 21 Burling Slip, Manhattan, New York. International Convention date, June 17, 1921.

2-aminoanthraquinone is fused with less alkali than usual, in the presence of an indifferent solvent or diluent such as purified kerosene oil, to produce N-dihydro-1 : 2 : 1 ^{1} : 2^1 -anthraquinoneazine.

181,677. SILICATES, DECOMPOSITION OF. G. A. Blanc, 56, Via Fontanella di Borghese, Rome. International Convention date, June 14, 1921.

Granulated leucite is treated with an acid solution which is continuously circulated downward through it by means of a pump, and solutions of potassium and aluminium salts are obtained. After passing through the leucite, the liquor is passed downwards through a tower through which vapour of hydrochloric acid or nitric acid passes upwards. The acid is thus replenished and its heat of solution is used to heat the circulating liquor. Sulphuric acid may also be used.

182,112. ETHERS AND ESTERS. Consortium für Elektrochemische Industrie Ges., 20, Zielstattstrasse, Munich Germany. International Convention date, June 23, 1921.

A mixture of acetylene and a vapour of a compound containing hydroxyl or carboxyl groups, is passed over a heated catalyst, such as cadmium, zinc, mercury, magnesium, barium, copper, silver, cerium, nickel or iron, or oxides or salts of these. The catalyst is supported on charcoal, pumice, or infusional earth, and the process is effected in a continuous cycle, the unused hydroxyl or carboxyl compound being mixed with more acetylene and returned to the reaction chamber. The products are ethers and esters of ethylidene glycol and vinyl alcohol. An example is given in which acetylene and acetic acid are passed over charcoal and cadmium acetate at 200° C. Ethylidene diacetate is obtained.

182,134. CYANAMIDE RESIDUES. Soc. d'Etudes Chimiques pour l'Industrie, 8, Quai du Cheval Blanc, Geneva. International Convention date, June 25, 1921.

The process is for utilising the residues obtained when calcium cyanamide is decomposed by acids to obtain nitrogenous compounds. If carbon dioxide or sulphur dioxide has been employed as the acid, the residue, consisting of calcium carbonate or sulphite, carbon, and impurities, is dried and mixed with urea or other assimilable nitrogenous compounds obtained from cyanamide, such as urea sulphate. The mixture is evaporated to dryness to obtain a fertiliser. The residue of calcium carbonate and carbon may alternatively be used to obtain quicklime and carbon dioxide by calcining it.

182,487. OXIDISING AROMATIC COMPOUNDS. A. Eckert, 676, Dr. Schmeykalstrasse, Liebwerd, Tetschen, Czecho-Slovakia. International Convention date, July 2, 1921.

Aromatic organic compounds are oxidised by means of oxygen under the influence of light and in the presence of anthraquinone, chloranthraquinone, or other substitution product. If other substances, such as acetic or other carboxylic acid anhydride, or acid chlorides, are present, other products such as esters may be obtained by reaction with the first products of the oxidation. In this manner, toluene may be oxidised by air to benzoic acid containing small proportions of benzaldehyde, dibenzyl, isohydrobenzoin, and hydrobenzoin. If acetic anhydride is present, benzyl acetate is obtained. The three xylenes may be similarly oxidised to toluic acids, ethylbenzene to acetophenone, and methyl naphthalenes to naphthalene carboxylic acids. Hydroquinone with glacial acetic acid and anthraquinone may be oxidised to quinhydrone, and β-methyl-anthraquinone is similarly oxidised to β-antbroic acid and β-β¹-dianthra-quinonylethane; 1-methoxy-2-methyl-anthraquinone is oxidised to 1-oxyanthraquinone-2-carboxylic acid, and 1-chloro-4-methylanthraquinone to 1-chloro-anthraquinone-4-carboxylic acid and 4 : 4¹-dichloro-1-1¹-dianthraquinonyl-ethane.

LATEST NOTIFICATIONS.

184,760. Process of evaporation and heat exchange. Caspar, C. N. August 17, 1921.
184,778. Process for purifying acetylene. Elektricitatswerk Lonza. August 18, 1921.
184,787. Purification of gases by cooling. L'Air Liquide, Soc. Anon. pour l'Etude et l'Exploitation des Procedes G. Claude. August 13, 1921.
184,788. Method of preventing bleeding in the operation of degumming raw silk in the presence of silk dyed with vat dyestuffs. Society of Chemical Industry in Basle. August 13, 1921.
184,795. Method of producing sulphides and hydrosulphides of the alkali metals. Ephraim, J. August 20, 1921.
184,798. Process of manufacture of lead oxides. Soc. Gamichon Frères. August 19, 1921.
184,800. Manufacture of artificial manure. Gradl, J. August 15, 1921.
184,816. Combined wet and dry magnetic separating process for the treatment of the residues of fuel. Meguin Akt.-Ges. August 21, 1921.

Specifications Accepted, with Date of Application

163,304. Anhydrous chlorides of alkaline earth metals, Process of manufacturing. Minami Manshu Tetsudo Kabushiki Kaisha. May 15, 1920.
163,719. Lignite, peat, turf, and the like, Drying of. K. W. J. H. Jacobs. May 27, 1920.
167,143. Cellulose butyrate, Process of preparing. A. D. Little, Inc. July 26, 1920.
168,324. Iodine, Process for recovering. O. von Faber. Aug. 28, 1920.
184,197. Cellulose esters, Process for utilising. J. Duclaux. Feb. 1, 1921.
184,206. Soluble phosphates, Process of manufacturing. J. G. Williams. Nov. 10, 1921.
184,242. Tar and other liquids, Process and apparatus for distilling. W. Glossop, L. Bradley, and R. W. Willsdon. May 2, 1921.
184,244. Potassium bi-carbonate from potassium chloride solutions, Process for the electrolytic production of. Chemische Fabrik Griesheim-Elektron and R. Suchy. May 2, 1921.
184,271. Clay, Treatment of. W. Feldenheimer and W. W. Plowman. May 9, 1921.
184,279. Analysis and recording of gases, Apparatus for. A. G. Dale. May 12, 1921.
184,281. Liquid hydrocarbons, Refining of. A. E. Dunstan. May 12, 1921.
184,284. Amines from phenolic compounds, Manufacture of. W. L. Galbraith, W. V. Shannan, W. G. Adam, and N. E. Siderfin. May 13, 1921.
184,292. Ichthyol oil and ichthyol preparations, and the like, Manufacture of. Plauson's (Parent Co.), Ltd. (*H. Plauson.*) May 21, 1921.
184,323. Gas-Producers. W. Climie. June 15, 1921.
184,360. Tanning agent for the chrome tannage or dyeing of leather, Preparation of. D. Burton and A. Glover. July 26, 1921.
184,402. Metalliferous materials, Process for dissolving-out or recovering the metal constituents of. H. Bardt. Oct. 10, 1921.
184,433. Mixing and/or disintegrating machines. C. E. Gardner. Mar. 1, 1921.

Applications for Patents

Boake, Roberts & Co., Ltd., A., and Bloomfield, A. L. Distilling and fractionating apparatus. 22781. August 22.
Burt, Boulton, and Haywood, Ltd. Grinding-mills. 23132. August 25.
Casale, L. Apparatus for catalytic synthesis of ammonia. 23072. August 24.
Fairlie, A. M. Acid plant equipment. 23083. August 25.
Gardner, D. Paints, etc. 22727. August 21.
—— and Taverner, L. Extraction of iron and titanium compounds from titanium ores. 22728. August 21.
Gradl, J. Manufacture of artificial manures. 22888. August 22. (Germany, September 3, 1921.)
—— Manufacture of artificial manures. 23067. August 24. (Germany, November 22, 1921.)
Johansson, N. H. Processes for denaturing alcohol, etc. 23143. August 25. (Sweden, August 26, 1921.)
Kalle and Co., Akt.-Ges., and Sokal, S. Process for producing vat colouring matters. 23033. August 24.
Lawrence Patent Water Softener and Sterilizer Co., Ltd., and Warden, F. J. Proportioning, mixing, and dividing liquids and dissolving solids, etc. 23213. August 26.
Meguin Akt.-Ges. and Leopold, J. H. Magnetic separating process for treatment of residues of fuel. 22751. August 21. (Germany, August 21, 1921.)
Mathesius, H., and Mathesius, W. Process for producing lead alloys containing strontium. 23048. August 24. (Germany, August 24, 1921)
Nickum, W. D. Electrolytic apparatus, and method of depolarising same. 22859. August 22.
Nobel, L. A. Manufacture of ferro-chromium. 22951. August 23.
—— Production of ferro alloys. 22952. August 23.
Paterson, W. Apparatus for treating liquids by chemical reagents. 23063. August 24.
Plauson's (Parent Co.), Ltd., and Plauson, H. Treatment of cellulose, etc. 22687. August 21.
Techno-Chemical Laboratories, Ltd. Fluid-actuating devices. 22881. August 22.
Thomson, D. Disintegrating solids. 23155. August 25.
Villain, P. Manufacture of transparent soaps, etc. 22833. August 22.
Warmund, H. H. Process for production of compound for sealing pneumatic, etc., tyres and for preserving rubber. 22822. August 22. (Germany, August 22, 1921.)

Patents Court Cases

APPLICATION has been made under Sec. 24 of the Patents and Designs Acts, 1907 and 1919, for the following patent to be indorsed "Licence of Right": 143,848 (Soc. Anon. l'Oxhydrique Française) relating to a catalytic process and apparatus for use in the hydrogenation of oils and fatty bodies. Any notice of opposition must be given by Oct. 2, 1922.

Market Report and Current Prices

Our Market Report and Current Prices are exclusive to* THE CHEMICAL AGE, *and, being independently prepared with absolute impartiality by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., may be accepted as authoritative. The prices given apply to fair quantities delivered ex wharf or works, except where otherwise stated. The current prices are given mainly as a guide to works managers, chemists, and chemical engineers; those interested in close variations in prices should study the market report.

LONDON, AUGUST 31, 1922.

TRADE has been only moderate, but there has been an increased inquiry, and it is thought that, with the turn of the month, business will brighten up considerably.

Markets on the whole are firm, and there have been advances in one or two directions.

Deliveries from the Continent are very slow.

Export trade has been a shade better, but still leaves a great deal to be desired, especially with the continental markets.

General Chemicals

ACETONE is much firmer owing to the gradual and steady rise of acetate of lime, and there has been a sharp advance in price. Stocks are almost unobtainable.

ACID ACETIC is very firm, and stocks are light.

ACID CITRIC is only in poor request, and the price is inclined to be easy.

ACID FORMIC has been moderately active without change in value.

ACID LACTIC is in much better request and the price is firm.

ACID OXALIC has not been so active, and the price is inclined to be a shade easier.

ACID TARTARIC has been a little more active.

BARIUM CHLORIDE remains very firm and in short supply for near delivery.

COPPER SULPHATE is unchanged, with very little business passing.

CREAM OF TARTAR has been only in small request, and the price is nominally without change.

FORMALDEHYDE is inclined to be easier, with only a poor demand.

IRON SULPHATE is in small request.

LEAD ACETATE is as firm as ever and supplies are scarce.

LEAD NITRATE has been only moderately active.

LITHOPONE has been a better market at recent figures.

MAGNESIUM CHLORIDE is in poor request, and the price is unchanged.

POTASSIUM CARBONATE is in good supply, with only a small business reported.

POTASSIUM CAUSTIC is freely offered, with little business.

POTASSIUM CHLORATE has been a good market and the price is firm.

POTASSIUM PRUSSIATE is very active and supplies scarce.

SODIUM ACETATE continues in fair request at last quoted figures.

SODIUM NITRITE is in poor request, but the price is maintained.

SODIUM PHOSPHATE has been a little more active, but still leaves a good deal to be desired.

SODIUM PRUSSIATE has been in request, and the price is very firm.

WHITE LEAD is active.

ZINC OXIDE is scarce, particularly for the better grades.

Coal Tar Intermediates

Business continues comparatively unchanged, and little general improvement can be expected until the colour market improves.

ALPHA NAPHTHOL is steady at last quoted price.

ALPHA NAPHTHYLAMINE is unchanged.

ANILINE OIL continues to pass regularly into consumption.

ANILINE SALT has been inquired for on export account.

BENZIDINE BASE.—A fair home trade, with the price slightly easier.

BETA NAPHTHOL.—Some small home business is passing.

DIMETHYLANILINE is the turn easier.

DIPHENYLAMINE is very firm, with some home business passing.

"G" SALT has been inquired for on export account.

"H" ACID is firm and steady.

NAPHTHIONIC ACID is quiet.

NITROBENZOL has been slightly more interesting on home account. The price is unchanged.

PARANITRANILINE.—A certain amount of home business.

PARAPHENYLENEDIAMINE is firm.

"R" SALT.—Export orders are in the market.

RESORCIN is a fair home trade.

Coal Tar Products

THE market generally for coal tar products is maintaining a firm tone, and there is a fairly active demand for most coal tar products, particularly carbolic.

90's BENZOL is in very fair demand, and is worth from 2s. to 2s. 1d. per gallon on rails.

PURE BENZOL is somewhat uninteresting and is worth about 2s. 4d. to 2s. 6d. per gallon on rails.

CREOSOTE OIL is scarce for prompt delivery, and prices are very irregular, ranging from 5½d. to 6½d. in the North, and from 6½d. to 7½d. per gallon in the South.

CRESYLIC ACID shows no change from last week, although it maintains a fairly firm tone. The pale quality, 97/99%, is worth about 2s. 3d. to 2s. 4d. per gallon on rails, while the dark quality, 95/97%, is worth about 2s. per gallon on rails.

SOLVENT NAPHTHA.—There is little fresh business reported in solvent. It is worth about 1s. 9d. per gallon on rails.

HEAVY NAPHTHA is in poor demand, and is worth about 1s. 7d. on rails.

NAPHTHALENE is weak, with little inquiry.

PITCH remains firm with good demand for home trade and for export. To-day's quotations are 85s. per ton f.o.b. London; 82s. 6d. per ton f.o.b. East Coast port.

Sulphate of Ammonia

The position shows no change from last week. There is a good demand, and the market has a firm tendency.

Current Prices

Chemicals

	Per	£	s.	d.		£	s.	d.
Acetic anhydride	lb.	0	1	8	to	0	1	10
Acetone oil	ton	80	0	0	to	82	10	0
Acetone, pure	ton	85	10	0	to	87	10	0
Acid, Acetic, glacial, 99–100%	ton	67	0	0	to	68	0	0
Acetic, 80% pure	ton	47	0	0	to	48	0	0
Arsenic, liquid, 2000 s.g.	ton	67	0	0	to	70	0	0
Boric, cryst.	ton	60	0	0	to	65	0	0
Carbolic, cryst. 39–40%	lb.	0	0	6	to	0	0	6½
Citric	lb.	0	2	3	to	0	2	4
Formic, 80%	ton	65	0	0	to	66	0	0
Gallic, pure	lb.	0	2	11	to	0	3	0
Hydrofluoric	lb.	0	0	7½	to	0	0	8½
Lactic, 50 vol.	ton	40	0	0	to	43	0	0
Lactic, 60 vol.	ton	43	0	0	to	45	0	0
Nitric, 80 Tw.	ton	30	0	0	to	31	0	0
Oxalic	lb.	0	0	7¾	to	0	0	8
Phosphoric, 1.5	ton	38	0	0	to	40	0	0
Pyrogallic, cryst.	lb.	0	6	0	to	0	6	3
Salicylic, Technical	lb.	0	0	10½	to	0	1	0
Salicylic, B.P.	lb.	0	1	5	to	0	1	6
Sulphuric, 92–93%	ton	7	10	0	to	8	0	0
Tannic, commercial	lb.	0	2	3	to	0	2	9
Tartaric	lb.	0	1	4½	to	0	1	5
Alum, lump	ton	10	0	0	to	10	10	0
Alum, chrome	ton	28	0	0	to	29	0	0
Alumino ferric	ton	9	0	0	to	9	5	0
Aluminium, sulphate, 14–15%	ton	10	10	0	to	11	0	0
Aluminium, sulphate, 17–18%	ton	11	10	0	to	12	0	0
Ammonia, anhydrous	lb.	0	1	8	to	0	1	9
Ammonia, .880	ton	33	0	0	to	35	0	0
Ammonia, .920	ton	21	0	0	to	23	0	0
Ammonia, carbonate	lb.	0	0	4	to	0	0	4½
Ammonia, chloride	ton	60	0	0	to	65	0	0
Ammonia, muriate (galvanisers)	ton	35	0	0	to	37	10	0

	Per	£	s.	d.		£	s.	d.
Ammonia, nitrate (pure)	ton	35	0	0	to	40	0	0
Ammonia, phosphate	ton	74	0	0	to	75	0	0
Ammonia, sulphocyanide	lb.	0	1	10	to	0	2	0
Amyl acetate	ton	175	0	0	to	185	0	0
Arsenic, white, powdered	ton	42	0	0	to	44	0	0
Barium, carbonate, 92–94%	ton	12	10	0	to	13	0	0
Barium, Chlorate	ton	60	0	0	to	68	0	0
Barium Chloride	ton	23	0	0	to	23	10	0
Nitrate	ton	27	10	0	to	30	0	0
Sulphate, blanc fixe, dry	ton	20	10	0	to	21	0	0
Sulphate, blanc fixe, pulp	ton	10	5	0	to	10	10	0
Sulphocyanide, 95%	lb.	0	1	0	to	0	1	3
Bleaching powder, 35–37%	ton	12	0	0	to		—	
Borax crystals	ton	29	0	0	to	33	0	0
Caffein	lb.	0	13	0	to	0	14	0
Calcium acetate, Brown	ton	9	10	0	to	10	10	0
" " Grey	ton	14	10	0	to	15	0	0
Calcium Carbide	ton	16	0	0	to	17	0	0
Chloride	ton	6	10	0	to		—	
Carbon bisulphide	ton	50	0	0	to	52	0	0
Casein, technical	ton	47	0	0	to	55	0	0
Cerium oxalate	lb.	0	4	6	to	0	4	9
Chromium acetate	lb.	0	1	1	to	0	1	3
Cobalt acetate	lb.	0	6	0	to	0	6	6
Oxide, black	lb.	0	9	6	to	0	10	0
Copper chloride	lb.	0	1	2	to	0	1	3
Sulphate	ton	26	10	0	to	27	0	0
Cream Tartar, 98–100%	ton	108	0	0	to	110	10	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde, 40% vol.	ton	68	10	0	to	70	0	0
Formusol (Rongalite)	lb.	0	2	6	to	0	2	9
Glauber salts, commercial	ton	5	0	0	to	5	10	0
Glycerine, crude	ton	65	0	0	to	67	10	0
Hydrogen peroxide, 12 vols.	gal.	0	2	5	to	0	2	6
Iron perchloride	ton	30	0	0	to	32	0	0
Iron sulphate (Copperas)	ton	4	0	0	to	4	5	0
Lead acetate, white	ton	41	0	0	to	42	0	0
Carbonate (White Lead)	ton	43	0	0	to	47	0	0
Nitrate	ton	46	10	0	to	48	10	0
Litharge	ton	35	10	0	to	36	0	0
Lithopone, 30%	ton	23	10	0	to	24	0	0
Magnesium chloride	ton	7	0	0	to	7	10	0
Carbonate, light	cwt.	2	10	0	to	2	15	0
Sulphate (Epsom salts commercial)	ton	8	0	0	to	8	10	0
Sulphate (Druggists')	ton	13	10	0	to	14	10	0
Manganese, Borate, commercial	ton	65	0	0	to	75	0	0
Sulphate	ton	60	0	0	to	62	0	0
Methyl acetone	ton	70	0	0	to	75	0	0
Alcohol, 1% acetone	ton	70	10	0	to	75	0	0
Nickel sulphate, single salt	ton	49	0	0	to	51	0	0
Ammonium sulphate, double salt	ton	51	0	0	to	52	0	0
Potash, Caustic	ton	33	0	0	to	34	0	0
Potassium bichromate	lb.	0	0	6½	to		—	
Carbonate, 90%	ton	31	0	0	to	33	0	0
Chloride, 80%	ton	12	0	0	to	12	10	0
Chlorate	lb.	0	0	4½	to	0	0	5
Metabisulphite, 50–52%	ton	84	0	0	to	90	0	0
Nitrate, refined	ton	45	0	0	to	47	0	0
Permanganate	lb.	0	0	9	to	0	0	10
Prussiate, red	lb.	0	4	6	to	0	4	9
Prussiate, yellow	lb.	0	1	7½	to	0	1	8½
Sulphate, 90%	ton	13	0	0	to	13	10	0
Salammoniac, firsts	cwt.	3	3	0	to		—	
Seconds	cwt.	3	0	0	to		—	
Sodium acetate	ton	24	10	0	to	24	15	0
Arseniate, 45%	ton	45	0	0	to	48	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	0	5	to		—	
Bisulphite, 60–62%	ton	23	0	0	to	24	0	0
Chlorate	lb.	0	0	3¾	to	0	0	4
Caustic, 70%	ton	20	10	0	to	21	0	0
Caustic, 76%	ton	21	10	0	to	22	10	0
Hydrosulphite, powder, 85%	lb.	0	1	9	to	0	2	0
Hyposulphite, commercial	ton	12	10	0	to	13	10	0
Nitrite, 96–98%	ton	31	0	0	to	32	0	0
Phosphate, crystal	ton	16	10	0	to	17	0	0
Perborate	lb.	0	0	11	to	0	1	0
Prussiate	lb.	0	0	11	to	0	0	11½
Sulphide, crystals	ton	12	10	0	to	13	10	0
Sulphide, solid, 60–62%	ton	21	10	0	to	23	10	0
Sulphite, cryst.	ton	12	10	0	to	13	0	0
Strontium carbonate	ton	55	0	0	to	60	0	0
Strontium Nitrate	ton	50	0	0	to	55	0	0
Strontium Sulphate, white	ton	6	10	0	to	7	10	0
Sulphur chloride	ton	25	0	0	to	27	10	0
Sulphur, Flowers	ton	13	0	0	to	14	0	0
Roll	ton	13	0	0	to	14	0	0

	Per	£	s.	d.		£	s.	d.
Tartar emetic	lb.	0	1	6	to	0	1	7
Theobromine	lb.	0	14	0	to	0	14	6
Tin perchloride, 33%	lb.	0	1	2	to	0	1	4
Perchloride, solid	lb.	0	1	5	to	0	1	7
Protochloride (tin crystals)	lb.	0	1	5	to	0	1	6
Zinc chloride 102° Tw.	ton	21	0	0	to	22	10	0
Chloride, solid, 96–98%	ton	25	0	0	to	30	0	0
Oxide, 99%	ton	36	0	0	to	38	0	0
Dust, 90%	ton	45	0	0	to	47	10	0
Sulphate	ton	18	10	0	to	19	10	0

Coal Tar Intermediates, &c.

	Per	£	s.	d.		£	s.	d.
Alphanaphthol, crude	lb.	0	2	3	to	0	2	6
Alphanaphthol, refined	lb.	0	3	0	to	0	3	3
Alphanaphthylamine	lb.	0	2	0	to	0	2	1
Aniline oil, drums extra	lb.	0	1	0	to	0	1	1
Aniline salts	lb.	0	1	1	to	0	1	2
Anthracene, 40–50%	unit	0	0	8½	to	0	0	9
Benzaldehyde (free of chlorine)	lb.	0	3	9	to	0	4	3
Benzidine, base	lb.	0	5	9	to	0	6	0
Benzidine, sulphate	lb.	0	5	9	to	0	6	0
Benzoic acid	lb.	0	1	9	to	0	2	0
Benzoate of soda	lb.	0	1	7½	to	0	1	9
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol benzoate	lb.	0	4	9	to	0	5	0
Betanaphthol	lb.	0	1	4	to	0	1	4½
Betanaphthylamine, technical	lb.	0	6	0	to	0	7	0
Croceine Acid, 100% basis	lb.	0	3	6	to	0	3	9
Dichlorbenzol	lb.	0	0	9	to	0	0	10
Diethylaniline	lb.	0	2	9	to	0	3	0
Dinitrobenzol	lb.	0	1	3	to	0	1	4
Dinitrochlorbenzol	lb.	0	0	11	to	0	1	0
Dinitronaphthalene	lb.	0	1	4	to	0	1	5
Dinitrotoluol	lb.	0	1	5	to	0	1	6
Dinitrophenol	lb.	0	2	9	to	0	3	0
Dimethylaniline	lb.	0	2	3	to	0	2	6
Diphenylamine	lb.	0	4	3	to	0	4	6
H-Acid	lb.	0	6	6	to	0	7	0
Metaphenylenediamine	lb.	0	5	6	to	0	5	9
Monochlorbenzol	lb.	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	6	0	to	0	6	6½
Metatoluylenediamine	lb.	0	4	6	to	0	4	9
Monosulphonic Acid (2.7)	lb.	0	5	6	to	0	6	0
Naphthionic acid, crude	lb.	0	3	0	to	0	3	3
Naphthionate of Soda	lb.	0	3	0	to	0	3	3
Naphthylamin-di-sulphonic-acid	lb.	0	4	0	to	0	4	3
Neville Winther Acid	lb.	0	7	9	to	0	8	0
Nitrobenzol	lb.	0	0	9	to	0	0	9½
Nitronaphthalene	lb.	0	1	4	to	0	1	5
Nitrotoluol	lb.	0	1	0	to	0	1	2
Orthoamidophenol, base	lb.	0	10	0	to	0	10	5
Orthodichlorbenzol	lb.	0	1	0	to	0	1	1
Orthotoluidine	lb.	0	1	6	to	0	1	9
Orthonitrotoluol	lb.	0	0	10	to	0	1	0
Para-amidophenol, base	lb.	0	10	0	to	0	10	6
Para-amidophenol, hydrochlor	lb.	0	10	6	to	0	11	0
Paradichlorbenzol	lb.	0	0	6	to	0	0	7
Paranitraniline	lb.	0	3	6	to	0	3	9
Paranitrophenol	lb.	0	2	3	to	0	2	6
Paranitrotoluol	lb.	0	5	0	to	0	5	3
Paraphenylenediamine, distilled	lb.	0	10	6	to	0	10	9
Paratoluidine	lb.	0	7	0	to	0	7	6
Phthalic anhydride	lb.	0	2	9	to	0	3	0
Resorcin, technical	lb.	0	5	6	to	0	6	0
Resorcin, pure	lb.	0	7	0	to	0	7	3
Salol	lb.	0	2	0	to	0	2	3
Sulphanilic acid, crude	lb.	0	1	0	to	0	1	1
Tolidine, base	lb.	0	6	6	to	0	7	0
Tolidine, mixture	lb.	0	2	6	to	0	2	9

Industrial Uses of Bentonite

THE properties of bentonite, which were described by Mr. R. B. Ladoo in THE CHEMICAL AGE recently (Vol. V., page 834), appear to render this material suitable for a number of industrial purposes. One of its first commercial uses is probably in the de-inking of printed paper, and the method has been patented by the Paper De-inking Co., of Chicago. Although it has been comparatively easy to loosen the carbon black by means of soda ash or caustic soda, it has been difficult to wash out the carbon black after liberation, and previous methods of washing did not permit of its complete removal without excessive loss of pulp. Bentonite, however, will, it is claimed, pass through ordinary filters, and with its large surface, on account of the extreme fineness of its particles, will carry the carbon black along with it.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to* THE CHEMICAL AGE *by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

GLASGOW, AUGUST 30, 1922.

THERE is little of importance to record this week. Inquiries continue fairly numerous, but the number of orders booked is small.

Prices for English manufactured chemicals are steady, and consequent on the further fall of German currency Continental offers are plentiful and prices named low.

Industrial Chemicals

ACID ACETIC.—Glacial 98-100 per cent., £55 to £56 per ton; 80 per cent. technical, £38 to £40 per ton; 80 per cent. pure, £45 to £46 per ton.

ACID BORACIC.—Crystal or granulated, £60 per ton; powdered £62 per ton.

ACID CARBOLIC.—Offered at 6d. per lb.

ACID FORMIC, 85 per cent.—5 ton lots offered from the Continent at £42 10s. per ton, carboys extra, f.o.b. Hamburg.

ACID HYDROCHLORIC.—Price unchanged, 6s. 6d. per carboy, ex works.

ACID NITRIC, 80°.—On offer at £26 per ton, ex works.

ACID OXALIC.—Quoted 7¾d. per lb., ex store.

ACID SULPHURIC.—144°, £4 per ton; 168°, £7 5s. per ton, ex works. De-arsenicated quality £1 per ton more.

ACID TANNIC, TECHNICAL, 76-80 per cent.—Offered at 1s. 8d. per lb., ex store, Liverpool.

ACID TARTARIC.—Continental offers, 1s. 3d. per lb., f.o.b. Hamburg.

ALUM, LUMP POTASH.—On offer at £14 10s. per ton, ex store.

ALUMINA SULPHATE.—Continental offers of £7 per ton, c.i.f. for 17-18 per cent.; £6 per ton for 14-15 per cent.

AMMONIA ANHYDROUS.—Quoted 1s. 8d. per lb., ex works.

AMMONIA CARBONATE.—Lump, 4d. per lb.; powdered, 4¼d. per lb. delivered.

AMMONIA MURIATE.—Galvanisers grey about £35 per ton; fine white crystals about £32 per ton.

AMMONIA SULPHATE.—25¼ per cent., £14 10s.; 25¾ per cent. neutral quality, £15 13s. per ton, ex works prompt.

ARSENIC, WHITE POWDERED.—Supplies for spot delivery are scarce. Price about £45 per ton, ex quay.

BARIUM CHLORIDE.—Continental material offered at £16 per ton c.i.f. for 98/99 %

BARYTES.—Finest white English, £5 5s. per ton, ex works.

BLEACHING POWDER.—Price, £12 15s. per ton, ex station, spot delivery.

BORAX.—No change in price. Crystal or granulated, £29 per ton; powdered, £30 per ton.

BROMINE, LIQUID, PURE.—Offered at 7¼d. per lb. nett, ex store, London.

CALCIUM CARBIDE.—Price about £16 to £17 per ton ex store.

CALCIUM CHLORIDE.—English make, £6 per ton, ex quay or station.

COPPER SULPHATE.—Offered at £26 10s. per ton, ex quay.

COPPERAS, GREEN.—Price, £3 15s. to £4 per ton, ex works.

FORMALDEHYDE, 40%.—Offered for forward delivery at £60 per ton c.i.f. duty free. Spot lots about £66 to £67 per ton.

GLAUBER SALTS.—Fine white crystals £5 per ton; large crystals, £4 per ton.

GLYCERIN, B.P. 1260.—88/6d. per cwt. in tins in cases, ex wharf, London.

LEAD.—Red, now £37 15s. per ton delivered; white, £49 15s. per ton delivered. Both minimum 5 ton lots.

LEAD ACETATE.—White crystals on offer at £37 c.i.f. U.K.

MAGNESITE, GROUND CALCINED.—£9 to £12 per ton, according to quality.

MAGNESIUM CHLORIDE.—Offered at £6 15s per ton, spot delivery. Continental offers of £4 15s. c.i.f. U.K.

MAGNESIUM SULPHATE (EPSOM SALTS).—No change in price. Commercial, £7 5s. per ton; B.P., £9 10s. per ton.

POTASSIUM BICHROMATE.—English makers' price, 6¼d. per lb. delivered.

POTASSIUM CARBONATE, 90/92%.—Spot lots on offer at £30 per ton ex store.

POTASSIUM CAUSTIC, 88/90%.—Quoted £31 per ton, spot delivery.

POTASSIUM CHLORATE.—On offer at 4¼d. per lb.

POTASSIUM NITRATE (SALTPETRE).—Spot lots quoted £33 to £34 per ton, ex store.

POTASSIUM PERMANGANATE.—Unchanged at about 8½d. to 9d. per lb.

POTASSIUM PRUSSIATE (YELLOW). Now quoted 1s. 8d. per lb. delivered. Spot lots scarce.

SODIUM ACETATE CRYSTALS.—Some inquiry. Price £23 per ton. f.o.r. makers' works.

SODIUM BICARBONATE.—Price unchanged, £10 10s. per ton, ex station; m.w. quality, £1 per ton less.

SODIUM BICHROMATE.—English makers' price 5d. per lb. delivered.

SODIUM CARBONATE (SODA CRYSTALS).—£5 15s. per ton ex quay.

SODIUM CARBONATE (ALKALI).—Spot lots £9 1s. 6d. per ton, ex quay or station.

SODIUM CAUSTIC.—Prices unchanged. 76/77%, £23 5s.; 70/72%, £21 5s.; 60% broken, £24; powdered 98/99%, £26 15s. to £27 15s. per ton, ex station; bottoms, 70/72% £14 per ton.

SODIUM HYPOSULPHITE.—Commercial quoted, £13 10s. per ton, ex station; pea crystals, £19 10s. per ton.

SODIUM NITRATE.—Price £14 per ton, f.o.b. or f.o.r.

SODIUM NITRITE, 96/98%.—Offered at £26 16s. per ton, c.i.f. Manchester, basis 100%, packages free.

SODIUM PRUSSIATE, YELLOW.—Spot lots offered at 11½ per lb. delivered.

SODIUM SILICATE, 39/40%.—Continental offers, £2 per ton, f.o.b. Hamburg.

SODIUM SULPHATE (SALTCAKE 95%).—Price unchanged at £4 per ton.

SODIUM SULPHIDE, 60/62% CONC.—Offered at £16 per ton, c.i.f. U.K.

SULPHUR.—Government surplus stock of Sicilian available at £4 5s. per ton; flowers, £13; roll, £12; rock, £11; ground, £11 per ton, ex store.

TIN CRYSTALS.—On offer at 1s. 2d. per lb.

UREA, REFINED CRYSTALS.—Offered at 2s. per lb. delivered, in tins.

ZINC CHLORIDE.—Price about £22 to £23 per ton, ex wharf.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

BENZIDINE, TECHNICAL.—Small inquiry. Price quoted, 7s. per lb. 100 % basis.

BENZYL CHLORIDE TECHNICAL.—Some inquiry for export. Price quoted, 2s. 3d. per lb. f.o.b. U.K., drums included.

BETANAPHTHOL.—Small inquiry. Price still firm at 1s. 2d. per lb. delivered.

DIPHENYLAMINE.—Several inquiries. Price firm at 4s. 3d. per lb., packages inclusive.

SULPHANILIC ACID.—Spot parcels offered at 1s. 9d. per lb. ex store Manchester.

Investigation of Stage Eduction Theory

AT the Salt Lake City experimental station of the U.S.A. Bureau of Mines, a study has been mde of the "stage eduction" theory in the distillation of oil shale. It has been claimed that it is possible to produce, by distillation from oil shale, a series of crude oils which vary greatly in specific gravity, the light oils being produced first at the lower temperatures and heavy oils at the end of the distillation at the higher temperatures. The results of the study show that the difference in the properties of the oil produced at any stage of the distillation is so slight that the advantage of attempting to collect oils of greatly differing gravities, as the oils are produced from the retort, is negligible.

German Chemical Trade Notes

FROM OUR OWN CORRESPONDENT.

Berlin, August 28, 1922.

THE general situation in regard to chemicals shows little change from last week. Holders are chary of selling and there is a slightly brisker demand, particularly from abroad. Owing to the scarcity of the majority of chemicals, however, actual business passing is practically negligible.

The following average quotations are given in marks per kilogram (d.= domestic price; e.=export price). In some cases the amount is quoted in sterling or in American dollars:—

ACIDS: Acetic is unquoted. Acetyl-Salicylic, 575 mk. d.; 875 mk. e. Benzoic, 360 mk. d. Boric, 347.50 mk. d. Citric has advanced to 1,050 mk. d.; 1,050 mk. e. Formic, 65%, 70 mk. d. Oxalic, 85 mk. d.; 260 mk. e. Salicylic, 425 mk. d. Tartaric, increased to 590 mk. d. for crystallised goods; powdered, 600 mk. d.

INDUSTRIAL CHEMICALS: Alum: potash, crystal powder, 22 mk. d. 39 mk. e.; potash in lumps is not quoted; chrome, 15%, £28 e. Alumina Sulphate, 14/15%, 25 mk. e.; 17/18%, 37 mk. e. Ammonia Carbonate, powdered, 35 mk. d.; 95 mk. e. Arsenic, white, £46 e. Barium Chloride, crystallised, $7.50 e. Benzaldehyde, 350 mk. d.; 450 mk. e. Bleaching Powder, 26 mk. d.; 40 mk. e. Borax, crystallised, 171 mk. d. Calcium Chloride, 90/95%, 50 mk. e. Copperas, 12 mk. d.; 15/16 mk. e. Copper Sulphate, 98/100%, $27.10 e. Dextrine, light yellow, 86 mk. d. Epsom Salt, 7 mk. d.; 10 mk. e. Formaldehyde, 40%, 190 mk. e. Glauber's Salt, crystallised, 5 mk. d.; 9.50 mk. e. Glycerin, 28° Bé., chemically pure, 325 mk. d. Lead, Red, 165 mk. d.; 185/190 mk. e. Lead, White, unquoted. Sugar of Lead, 140 mk. d.; £40 e. Litharge, 135 mk. d.; 160 mk. e. Lithopone, 62 mk. d.; 90 mk. e. Magnesium Chloride, fused, 16 mk. e. in barrels. Naphthalene, in flakes, advanced to 48 mk. d.; 70 mk. e. Potassium Bichromate, 240 mk. d.; $25 e. Potassium Carbonate, 96/98%, 75 mk. d.; 150 mk. e. Potash Caustic, 70 mk. d.; 145 mk. e; liquor, 25 mk. d. Potassium Chlorate, 75 mk. d.; 105 mk. e. Potassium Permanganate, 300 mk. d.; 360 mk. e. Sal Ammoniac, fine crystallised, 78 mk. d.; 110 mk. e. Sal Ammoniac, Spirit, 24 mk. d.; 54 mk. e. Salt Cake, 10 mk. d.; 18/19 mk. e. Soda Ash, 96/98%, 36 mk. d. Sodium Bicarbonate, 27 mk. d.; 45 mk. e. Soda, Caustic, scarce at 72 mk. d.; $8.25 e. Sodium Hyposulphite, crystallised, 35 mk. d.; 40 mk. e.; pea-form, 38 mk. d.; 47 mk. e. Sodium Silicate, 10 mk. d.; 14 mk. e. Sodium Sulphide, 30/32%, 22 mk. d.; 29 mk. e.; 60/62%, concentrated, 40 mk. d.; 70 mk. e. Zinc Chloride, 56 mk. d.; 83/86 mk. e. Zinc White, 140 mk. d.; £34 e. Bone Glue, transparent, 170 mk. d.; strong glue, 170 mk. d.; skin glue, A1 quality, 190 mk. d.

Chilean Nitrate Situation

TIME has not yet brought the improvement in the nitrate of soda position, which was so confidently anticipated in authoritative quarters, states a special correspondent of *The Times*, in a report from Valparaiso. It was fully expected that by the end of June the stocks of the London Pool would be exhausted and, in addition, a fair quantity of the stocks on the coast would be absorbed, and that producers would be able to breathe again. However, when the end of June arrived, the Pool still had over 100,000 tons of nitrate on its hands, while the sales on the coast are hardly keeping pace with the new production. Referring to the action of the Association of Producers in fixing the scale of prices which will rule from July to next June, he states there was a considerable struggle among the interested parties before the rates were finally arranged. After several meetings the policy of medium prices was finally adopted.

It is quite true, he adds, that the sulphate of ammonia position is, from the point of view of nitrate producers, very satisfactory, but the shortage of this fertiliser is not likely to be permanent. It is true also that Germany has had a great set back through the Oppau disaster, but no one who has a knowledge of German methods can think that this will be a permanent handicap, but rather that it will spur her on to fresh efforts. Therefore, it is clear, even to the most obtuse, that the days of high prices for the Chilean product are a thing of the past and that the future watchwords of the industry must be "cheapness" and "propaganda."

The writer adds that there is one point that should not be lost sight of by anyone, and that is the very liberal behaviour of the Government of Chile in the matter of the export duty. During the war-time period of hugely inflated prices of nitrate the Government did not raise the export tax by one cent. No one will deny that it would have been amply justified in doing so.

Dealing with the future of nitrate he states that the universal feeling is that the present unsatisfactory position will before long pass away. The London Pool should be able to liquidate its remaining stocks, and a healthier position all round be created. On all sides synthetic nitrate is offering serious competition, and this will increase. In conclusion, he says it must be remembered that the Chilean product is the most favourable form of the fertiliser, the most easily handled, and therefore the most acceptable to agriculturists. For this reason Chile starts with a great advantage, and if only those responsible keep prices low and organise the propaganda in a businesslike manner, there should be a sound future for the Chilean product, in spite of all German and indeed any other opposition.

Japan Rejects Proposed Dye Embargo

IT is reported that Japan has declined to grant either a dye embargo or higher rates to protect it from foreign imports. The dye situation in Japan is analogous to that in America, the industry having been developed since the war. Recent reports had indicated that the licensing system would be adopted and the final report came as a surprise. The domestic manufacturers were asking an increase in duties of from 35 per cent. *ad valorem* to 70 per cent. and a licensing system to cover eighteen colours satisfactorily produced in Japan. The market for Japanese dyestuffs is now limited to buyers in nearby Oriental markets, and even then quotations and sales must be made at an extremely low price. The local Japanese market is quite overstocked with German goods, against which American, French and Italian dyes are competing. On the other hand, the depressed condition of the textile trade furnishes little relief for the excessive stock of dyes. It is indicated that the present rate of 35 per cent. *ad valorem* will stand without any increase, and that no special provisions will be adopted.

According to *Chemical and Metallurgical Engineering*, the colours of Japanese manufacture which are generally giving a degree of satisfaction in the home market and for which protection against imported goods is desired are: Rhodamine B, aniline methyl violet, bismarck brown, fast red A, malachite green, direct black, naphthol brown, cotton violet, sulphur black, sulphur brown, magenta, orange A, and Congo red.

Transport of Liquid Rubber Latex

A CARGO of 16,600 gallons of liquid rubber latex has recently passed through Colombo for North America. Commenting on this fact a *Times* correspondent at Kalutara states that the latex is said to be kept in liquid form by the addition of ammonia. All the latex so far transported was brought to Singapore in iron drums, and emptied into specially prepared tanks on board ship. At the destination the consignee pumps the latex into his own tanks. Consignments transported so far are reported to have reached their destination quite satisfactorily. It is said that the paper manufacturer who is using the latex shipped to the United States has now placed with a Singapore firm an order for 3,000 tons of latex treated as before. It is not likely that so much material would be ordered if transport experiments, using a cheaper anti-coagulant than ammonia, have not succeeded, and if there is not sufficient certainty of a fair return on the capital invested. It is reported in well-informed commercial circles at Colombo that an English firm is now in negotiation with a large Colombo firm in regard to the transport of latex to England, but for what purpose is not definitely known.

Birmingham University Metallurgical Society

THE Birmingham University Metallurgical Society have arranged an interesting programme for the coming session. Numerous visits are contemplated to works and factories in the district where metallurgical processes are in operation. On November 14, Mr. C. Grant Robertson, Principal of the University, will give an address on "Science and a Liberal Education." Professor Burstall will speak on January 16 on "Materials Used in Engineering Construction." Sir Robert A. Hadfield will lecture on February 13 on "The Work and Position of the Metallurgical Chemist," and a number of other papers will be read during the term. The annual meeting is fixed for May 15 next.

Company News

BRIMSDOWN LEAD CO., LTD.—The share registers and transfer books will be closed from September 4 to 18 inclusive.

WILSON BROTHERS' BOBBIN CO.—The directors announce a dividend of 10 per cent. for the year; £5,000 is placed to reserve, £12,000 to depreciation, and £8,418 is carried forward.

PINCHIN, JOHNSON AND CO.—An interim dividend is announced of 5 per cent. actual on the ordinary shares on account of the half year to June 30 last, this amount was payable on Thursday.

MINERALS SEPARATION, LTD.—(North American Corporation.) Dealings in 500,000 shares without nominal or par value (temporary certificates), have been specially allowed by the Stock Exchange Committee under Rule 148A.

BRITISH ALIZARINE CO., LTD.—No dividend is being paid for the past year. In February, 1920, a bonus of 45 per cent. was distributed in fully paid shares out of the reserve fund, and for that year 10 per cent. was paid, the original and bonus shares ranking for a full year's dividend, as well as the 300,000 newly issued shares.

ARIZONA COPPER CO.—Rumours have been current to the effect that the company have received an offer from an American group to purchase the whole of the company's shareholding in the Phelps-Dodge Corporation at a figure which would yield 25s. per share to the Arizona shareholders. The rumour does not appear to have been officially confirmed or denied.

ENGLISH MARGARINE WORKS (1919).—The accounts for the past year show a profit of £108,595, from which has to be deducted a debit balance from the previous year, of £48,352; £10,000 is placed to reserve for plant depreciation; after allowing for a dividend on the preference shares paid up to March last at 7 per cent. per annum, less tax, there remains a balance of £9,240 to be carried forward.

AMERICAN CYANAMID CO.—The report for the year to June 30 last states that the gross profit was $624,784, after charging $699,081 for depreciation, and the net income was $197,992, after providing reserves of $288,975 for income tax and depreciation of patents. The surplus account shows a decrease of £148,213 for the year, and now stands at $3,143,276 in addition to various reserves totalling $4,200,246. The directors consider the year's results to be gratifying, in view of the abnormal conditions prevailing and the reduced activity in most departments of the company.

GOODLASS, WALL AND CO.—The accounts for the year to June 30 last show that, including £4,708 brought in and the amount recovered from excess profits duty, £16,149, there is a credit to profit and loss of £38,727. After paying the preference dividends the directors recommend a dividend of 1s. 3d. per share (or 6¼ per cent.), less tax; it has been decided to write off formation expenses £2,000, and (after paying corporation profits tax for year) carry forward the balance. Taxation has pressed very heavily on the company, absorbing a sum which represents a dividend of more than 10 per cent. on the ordinary share capital. In the first six months of the financial year, the company, in common with others, felt the great slump in trade, and though every economy was exercised, it was only possible to reduce the standing charges gradually. The annual meeting was held at the Law Association's Rooms, Cook Street, Liverpool, on Thursday.

Joint Stock Companies

A NOTICE in the *London Gazette*, dated August 25, states that in three months from that date the names of the following companies will, unless cause is shown to the contrary, be struck off the Register, and the companies will be dissolved: British Resorcin Manufacturing Co., Ltd.; Burton Chemical and Fodder Co., Ltd.; General Catalytic Process, Ltd.; Glassware and Chemicals, Ltd.; Pomeroy's, Ltd.; Silica Properties, Ltd.; and Victory Fire-Lighter Co., Ltd.

Recent Will

Mr. Henry Compton, M.B.E., of Kensington Palace Mansions, London, a director of the Imperial Light, Ltd., and of the New Explosives Co., Ltd. £119,475

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

LOCALITY OF FIRM OR AGENT.	MATERIAL.	REF. NO.
Sweden	Essential oils, flavouring essences, caramel.	—
Melbourne	Sodium acetate	D.O.T. 9320/ E.D./C.P. 205
British East Africa.	Oils, greases, soap	
Santo Domingo	Drugs, perfumery	D.O.T. 6595/ F.L./E.P.

Tariff Changes

AUSTRALIA.—New regulations relating to drawback allowance and fixing the basis of valuation for Customs duty were published in the *Board of Trade Journal* of August 24, p. 221.

NEW ZEALAND.—The prohibition on the importation into, and exportation from, New Zealand of tungsten and its alloys, compounds, and ores, except under licence has been removed.

DOMINICA.—Sulphuric acid which the Collector of Customs is satisfied is imported for the manufacture of citric acid has been added to the list of articles which may be imported into Dominica free of Customs duty.

GREAT BRITAIN.—The Board of Trade have issued an open General Licence authorising the exportation to all destinations of basic slag, superphosphate of lime, and manures, compound, containing either basic slag or superphosphate of lime.

PERU.—The export duty on petroleum and its components, products derived from its distillation, and its similar carbohydrates is fixed at 3.50 soles per metric ton (net weight), as from February 28 last. It is also provided that the export duty shall not be increased within a period of twenty years.

CANADA.—A cabled message from the Canadian Department of Customs and Excise, Ottawa, states that the British exporters' declaration on invoices of the home consumption value of goods in standard currency does not require confirmation by bank or Trade Commissioner. Under amended regulations now being issued currency certificates by bank or Trade Commissioner will be required only in respect of countries where currency is considered by the department to be substantially depreciated.

IRAQ.—The *Board of Trade Journal* for August 24 (p. 221) gives lists of amended import duties. The lists, which affect a number of chemicals and allied substances, impose a duty of 11 per cent. *ad valorem* on dyes and dyeing materials (unmanufactured); pitch, tar, and dammar; soda; tallow and stearine; and tanning materials (unmanufactured); an *ad valorem* duty of 15 per cent. applies, *inter alia*, to chemicals and chemical preparations; dyes and dyeing materials; paints and painting materials; perfumery and toilet preparations (other than those containing soap and spirit); and soaps. Goods dutiable at 20 per cent. *ad valorem* include explosives, fireworks, fish oil, saccharin, etc. The complete schedules of duties may be seen at the Tariff Section of the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

Whiteware Studies in Pacific North-west

THE United States Bureau of Mines, in co-operation with the University of Washington, will undertake an investigation of the residual kaolins and feldspars of Eastern Washington and North-western Idaho for whiteware bodies. The work to be done will follow the lines of the kaolin investigations now under way at the ceramic experiment station at Columbus, Ohio. The work will be done in the new mines laboratory of the University of Washington at Seattle.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[*NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.*]

BLUNT, W. H., AND SONS, 69½ and 70, Snow Hill, Birmingham, druggists. £19 2s. 1d. July 13.

DENNIS, E., 114, St. James Road, Northampton, chemist. £32 19s. 10d. June 21.

JACKSON, P. H., 162, Walton Road, East Moulsey, chemist. £17 4s. 8d. July 11.

KENNEDY, Adolph, 159, Kingsland Road, manufacturer of druggists' sundries. £63 19s. 7d. June 28.

MYER, R. H., 27, Lansdowne Gardens, Wandsworth, chemists' sundriesman. £38 3s. 5d. July 17.

ODELON, LTD., 387-9, Chapter Road, Cricklewood, eau de cologne manufacturers. £23 8s. 7d. June 26.

WALTON, B., 2, Royal Terrace, West Street, Southport, chemist. £22 2s. 3d. July 6.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

RADIUM AND CHEMICAL CO., LTD., London, E.C.—Registered August 17, deed dated July 28, 1922, agreeing to execute a trust deed for £25,000 debentures and giving further security for the debentures; charged on freehold property at Elmers End, Beckenham, formerly known as British Radium Extraction Works. *£1,500. February 24, 1922.

STELLA GILL COKE AND BYE-PRODUCTS CO., LTD., London, E.C.—Registered August 17, £6,000 and £41,600 debentures, part of £300,000; general charge (except uncalled capital). *£114,300. June 21, 1922.

TAYLOR'S DRUG CO., LTD., Leeds.—Registered August 15, £1,200 mortgage, to Mrs. E. Speight, 101, Harrogate Road, Leeds, and others; charged on 50, Market Street, Colne (Lancs). *£66,168 16s. 2d. November 28, 1921.

WOODCROFT MANUFACTURING CO., LTD., Liverpool, manufacturing chemists.—Registered August 21, £1,000 debenture, to J. W. Cocks, 17, Sweeting Street, Liverpool, solicitor; general charge. *£4,000. December 6, 1921.

Receiverships

A. H. CARTER, LTD.—S. T. Cuffe, of 141, Moorgate Street, E.C., was appointed receiver on August 16, under powers contained in debentures dated May 27, 1922.

COMMERCIAL COMMISSIONS, LTD.—E. H. Stringer, of 28, Basinghall Street, E.C., ceased to act as receiver or manager on August 21, 1922.

PETROLEUM PRODUCTS, LTD.—D. W. Wylie, of 61a, Bold Street, Liverpool, was appointed receiver and manager on April 23, 1922, under powers contained in debentures dated February 27, 1914.

London Gazette

Company Winding up Voluntarily

BRITANNIC CHEMICAL CO., LTD.—S. H. Vilven, secretary of the company, appointed liquidator.

Bankruptcy Information

DOUGLAS, Robert Steele Elliott, 62, Gibson Street, Newcastle-upon-Tyne, drug store proprietor. First meeting, September 7, 11 a.m., Official Receiver's Office, Pearl Buildings, 4, Northumberland Street, Newcastle-upon-Tyne. Public examination, October 5, 11 a.m., County Court, Westgate Road, Newcastle-upon-Tyne.

Application for Discharge

HIRCHBERG, Leon Maurice (described in the receiving order as C. M. Hirchberg), Ely Place, London, consulting chemist. Hearing, October 13, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

New Companies Registered

CARBOLEUM (SPAIN), LTD., 66, Victoria Street, London, S.W.1. Distillers of oils, etc., and manufacturers of and dealers in patent fuel, tar, etc. Nominal capital, £1,500 in £1 shares.

HERBERT AND CO., S. A. P. (1922), LTD., 23, Austin Friars, London, E.C. Manufacturers of and dealers in polishes, powders, wax and essential oils. Nominal capital, £40,000 in 5s. shares.

HINDLEY CHEMICAL CO., LTD., 88, Runcorn Road, Barnton, near Northwich. Manufacturers of and dealers in chemicals, fertilisers, oils, fats, glue, gelatine, etc. Nominal capital, £1,000 in £1 shares.

J. J. WHARMBY AND SON, LTD., 36, Wood Street, Mansfield, Notts. Manufacturing and Analytical Chemists, etc. Nominal capital, £10,000 in £1 shares.

Mineral Production in Canada

In the course of an interesting report on the mineral production of Canada during last year, issued under the authority of the Ministry of Trade and Commerce, it is shown that the aggregate value of the economic minerals produced amounted to 172·3 million Canadian dollars, as compared with a production of 237·4 million Canadian dollars in 1920. Gold, lead, and zinc showed increased quantities, and silver was about the same, while there were reductions in copper, nickel, and coal.

The principal mineral producing province of Canada, according to the returns for 1921, was Ontario, for which province the value of mineral production was 54,505,770 dols. British Columbia came second with a mineral production valued at nearly 35,000,000 dols. Nova Scotia was a close third with 32,500,000 dols. Alberta ranked fourth with 29,000,000 dols. Quebec was fifth with 14,600,000 dols., and Manitoba, Yukon Territory, New Brunswick, and Saskatchewan followed in the order named with productions between one and two million dollars each. The ten principal products of the mineral industries of Canada in 1921, arranged in order of the values assigned, were coal, gold, silver, copper, nickel, natural gas, asbestos, lead, zinc, and gypsum. Production values of these commodities ranged from 74,273,000 dols. for coal down to 1,725,000 dols. for gypsum, and in the aggregate the value of these ten commodities grouped in 1921 was 131,447,114 dols.

Lead and zinc ranked eighth and ninth respectively among the mineral products of Canada during the year, and notwithstanding the general decline in prices during the past two years the quantity of lead recovered increased more than 86 per cent. above the quantity produced in 1920 and was valued at almost 20 per cent. more than the output of the preceding year. Practically the whole of the production was from the smelters at Trail, which continued active throughout the year. Some lead was produced from Ontario and Quebec ores also, production from these provinces being about the same as in previous years. Zinc increased one-third in quantity but fell off 17 per cent. in value as compared with the production in the preceding year. The output of both metals was, however, most outstanding when the mineral industry as a whole is taken into consideration. Gypsum was the tenth product of value from the mines of Canada, the bulk of the production being from the Province of Nova Scotia; although Ontario, Manitoba, and New Brunswick also contributed substantially.